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ORIGINAL ARTICLES

SOME REASONS WHY THE GENERAL PRACTITIONER SHOULD NOT DO ORTHODONTIA

By E. G. Weeks, D.D.S., Saginaw, Mich.

IN CONSIDERING the subject of the general practitioner in relation to orthodontia I realize that I may be accused of personal motives and may be accused of trying to further my own interests as a practitioner of orthodontia. However, there are so many reasons why the general practitioner should not attempt the correction of malocclusions that I am going to attempt to show you some of these today and thereby substantiate the fact that orthodontia belongs to men who are educated along certain lines. I am willing to admit that in some instances general practitioners of dentistry may be able to correct simple cases of malocclusion, which may involve the correction of one or more teeth in the anterior region; but when the attempts to correct malocclusions involving the posterior teeth are considered, I believe the general practitioner is entirely out of his field. My reasons for coming to this conclusion are many. In the first place, the average general practitioner knows nothing about the normal occlusion of the teeth from the standpoint of forces of occlusion as being the factors in the production of normal occlusion. The average practitioner of dentistry knows little in regard to muscular stress relative to the eruption of the teeth, the effect of atmospheric pressure in the development of the mandible and the maxilla, the importance played by the inclined plane and the proximal contact points, and the intimate relation of harmony in the size of the arches as regards the correction of normal occlusion. If a general practitioner is ignorant of these things, which are fundamental basic principles in the correction of malocclusion, how can one expect him to obtain results in the correction of malocclusion that will reach any degree of efficiency.

I want to also condemn a practice which is being followed by a number of men in general dentistry, and which seems to a certain extent to fulfill a certain

need or desire among a number of men, and that is the correction or treating of malocclusions by a correspondence system. In fact the practice of dentistry is carried on entirely too much by the correspondence route. We have dental laboratories who attempt to make plates, crowns, inlays, and bridges for some man in Michigan, Illinois, or Missouri, and these restorations are made by men who have never seen the patient and are made in some distant laboratory in New York, Chicago, or some other foreign point. A similar system is springing up in the practice of orthodontia as there are a large number of orthodontic laboratories who make appliances over models for the general practitioner. Some of these orthodontic laboratories, that are interesting the men in practical appliances, are more or less honorable, and in some instances refuse to fit appliances to models, if in their minds the general practitioner of dentistry does not know enough about orthodontia to properly use the appliance after it is fitted to the model.

There are other laboratories or orthodontic manufacturers of appliances who will fit the appliance to any kind of a model for so much an appliance, expecting the dentist to obtain results or no results, whichever the case may be. The manufacturer of the appliance has received his price for the appliance, and feels perfectly free of the obligation.

There are other laboratories which claim to have a follow-up system of correspondence whereby they give advice to the general practitioner in regard to how a case should be treated. While I realize it is possible from the study of a model to design an appliance more or less suited to the case, the next proposition is whether the dentist for whom the appliance is made can properly use the appliance after it is adjusted to the model. Can the appliance be transferred from the model to the mouth so as to do the proper amount of work which it was designed to do? This is very much of a question.

Concerning the correction of teeth by the correspondence system, we find advertised in the dental journals at the present time, or at least in one journal, a very elaborate method under the term "Orthodontic Engineering" whereby charts are made of certain cases, appliances are designed, and the maps of malocclusion and charts are sent to the general practitioner, with the information that by following these orthodontic charts, he will be able to accomplish as satisfactory results as are accomplished by men who have been engaged in the practice of orthodontia for years. Admitting competent orthodontic engineering has a certain future and place in orthodontia, I do not believe it is possible by making a few maps of malocclusions to instruct the general practitioner so thoroughly that he can treat satisfactorily malocclusions, unless he has had other training along orthodontic lines.

I believe a large number of these advertised orthodontic appliances, and orthodontic engineering concerns are misleading, and hope that in the future dental journals and orthodontic journals will be more careful in advertising such concerns than they have in times past. I do not so much question the ability of the man making or designing the appliance for the dentist, for in his own office he may be a satisfactory and efficient workman; however, I do question the ability of the man to design an appliance for teeth he has never seen, advise what development is necessary in the facial growths of patients he has never

seen, and still expect the general practitioner to get a result which will be equal to the specialist who has the patient in his office and follows the case very carefully. Even after the appliance is properly designed, the case may be a failure because the general practitioner has not sufficient orthodontic technic to properly adjust the appliance, or get the greatest efficiency out of it in the particular type of malocclusion under treatment. It is also known that general practitioners are very prone to follow the advice given by certain prominent men in the dental profession, men who have been engaged in the practice of orthodontia, and I know of a large number of patients in our community who are going through life with deformed faces because they were following the advice taught by a certain man, and have teeth extracted in cases where the teeth should not have been extracted. I can only say that "a little knowledge is a dangerous thing" and a little orthodontic knowledge is probably more dangerous than any other kind. That the average practitioner knows very little about malocclusion can be very easily proved if you will ask him in regard to the development of the mandible and maxilla, the action of the osteoclast or the osteoblast, or even

Fig. 1.

for a concise and positive statement in regard to the classification of malocclusions. If you ask him anything about the principles of appliances, certain kinds of anchorage or retentions, it would be like talking a foreign language to him. If he does not know the fundamental principles of orthodontia, how can he be expected to even get a satisfactory or serviceable result for his patient? The general practitioner may be a very clever workman in certain dental lines, but that does not necessarily insure that he is capable of correcting the different types of malocclusion. In fact, sometimes the simplest types of malocclusion cause the most serious results because what appears to be a simple type is really a complicated condition.

Anyone who has been engaged for any length of time in the practice of orthodontia invariably has come across cases of older patients that have been treated in the past by dentists; and examination of that case almost invariably will reveal misplaced molars or premolars, extracted teeth, and very often results which are worse than in the beginning. We very often see cases that have been treated by dentists, who are general practitioners, for two or three years and results have not been accomplished in that time, and it is questionable

if they ever will be accomplished. I know of three cases in which premolars have been turned so the buccal cusps were to the lingual, which might be permissible in some instances, but which in this case probably resulted because the dentist did not know which way to turn the tooth.

To further substantiate my argument that the general practitioner should not treat malocclusion, I will show some of the cases which have come under my observation, which, to a certain extent, bear out my contention. A great many general practitioners pay very little attention to the occlusion of teeth and some even neglect to consider the dental apparatus sufficiently carefully to know what are present and what are missing.

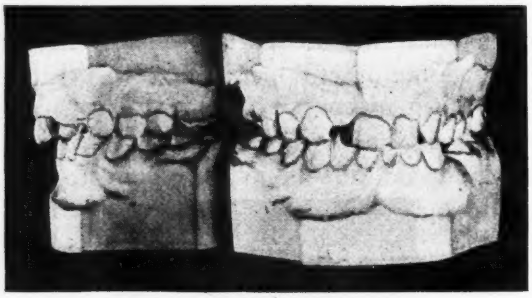

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1 shows a case in which the deciduous canine was present at eighteen years of age. A swelling or infection occurred around this tooth and the case was diagnosed as an abscess of a deciduous canine. The deciduous canine was extracted and a bridge was put in its place. For a short time the patient was relieved because of the opening and the establishment of drainage, but results were not as satisfactory as they seemed. The pain was not entirely relieved and there was considerable swelling. Iodine was used as a counterirritant until the patient could stand it no longer. Finally, upon the use of the x-ray, an impacted canine was revealed as is shown in Fig. 1; and not only was this canine impacted, but all four permanent canines were still unerupted.

Fig. 2 shows the model of a patient who had worn a bridge for a number of years to replace a missing central. The radiograph showed the right central to be in a right angle position to the lateral and in the floor of the right nostril. By cutting away the process with a large surgical burr and drilling a hole in the tooth and cementing a pin in the tooth it was possible to bring the tooth into very nearly perfect position at the present writing.

If such cases as these, with such malocclusions and impactions of teeth are overlooked, would one expect such men to be capable of treating complicated cases of malocclusion? As an example of some of the orthodontic results that have been obtained by general practitioners of dentistry I present Figs. 3 and 4,—the mother of one of my patients. This woman evidently had possessed a neutroclusion case with contraction of the upper anterior teeth and protruding canine, or tusks, as she called them. Her dentist straightened the case for $5.00, with the results which can be seen; that is, he extracted the two upper canines. The underdevelopment of the premaxillary region causes a very grave facial deformity, and while the case looks like a mesial occlusion case, the molars are actually in normal mesial relation.

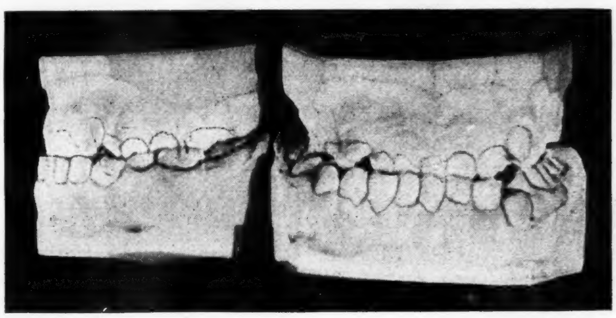

Fig. 5.

Fig. 5 shows the models of the daughter of the woman shown in Figs. 3 and 4. This is also a case of neutroclusion with lingual version of the upper molars and premolars and protruding canines. Owing to the fact that the mother had had such a satisfactory orthodontic result obtained for $5.00 her education was neglected and she supposed the daughter should be treated the same way. When I explained to the mother what was necessary, the length of time involved in completing the case, and the necessary expenditure, she was very much alarmed and concluded I was a robber. She insisted she would have the canines extracted for her daughter the same as had been done for her. However, owing to the influence which I had with the dentists in our city, the case was repeatedly referred back to me. For a year the mother and I had our arguments in regard to the proper kind of treatment, but finally the proper treatment was instituted and she is now one of my best friends.

Figs. 6 and 7 show the profile of a case before treatment. Fig. 8 shows the profile at the present time. In comparing the results obtained by treatment in the mother's case and the results which are being obtained for the daughter we have a very strong argument as to why the general practitioner should not attempt to correct a complicated case of malocclusion.

The large number of unsatisfactory results obtained in the practice of general practitioners in the correction of malocclusion are very easily cited. However, I wish here to report one case in which the history is more or less complete to show you the large amount of facial deformity that can be produced by a general practitioner in a very short time.

Fig. 9 is a photograph of a baby that shows a very good facial development and a good chin; in fact, the face is practically as normal as one would find at that age. Fig. 10 shows the patient at six years of age with a normally developed face because all the teeth are present and performing their proper

Fig. 6.

Fig. 7.

Fig. 8.

function. Fig. 11 shows the patient at nine with a good face, a well-developed chin and a normal dental apparatus. When her second upper premolars erupted, they came in slightly out of alignment and were pulled, as was also the lower second bicuspid. As soon as these teeth were extracted the development of the dental apparatus and the lower part of the face began to be abnormal and Fig. 12 shows the patient at the age of fourteen. The photographer, in order to get a better facial result, has tipped the chin in such a manner as to overcome the deformity. Figs. 13 and 14 show the facial result at nineteen years of age. There is no question in my mind but that the extreme facial deformity, the underdevelopment of the mandible and receding upper lip, has been produced by the extraction of the premolars which caused an underdevelopment of the dental arches, resulting in the underdeveloped face. A study of this patient's face

from babyhood to nineteen years of age is another proof as to why the general practitioner should not attempt the correction of malocclusion.

Fig. 15 shows the models of the faces shown in Figs. 13 and 14 at nineteen years of age. From a study of these models it is very evident that the man who extracted the bicuspids had absolutely no knowledge of the fundamental basic principles of orthodontia.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

I have called attention to the evils which may result from the man who attempts to use mail order appliances, and cite the case shown in Fig. 16 as an example. These models were made by a dentist who simply looked at the overlapping upper anterior teeth and concluded the proper thing to do was to order an appliance from a mail order house. The appliance was placed in position

Fig. 14.

Fig. 13.

and after three years of treatment the result shown in Fig. 17 was obtained. No attempt had been made to correct the distal occlusion, and in addition to that a bad overbite has been produced. Besides the patient having been suffering from the inconvenience of a long drawn out treatment, it is a grave question

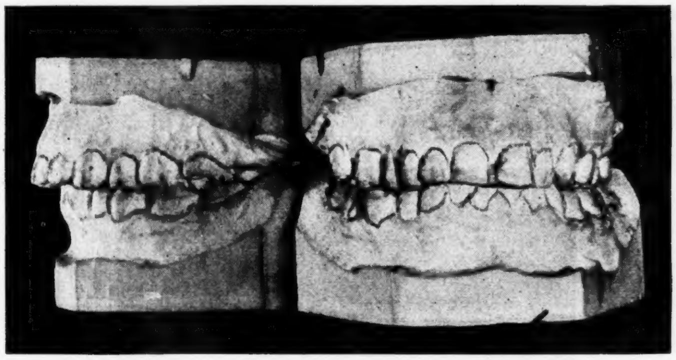

Fig. 15.

Fig. 16.

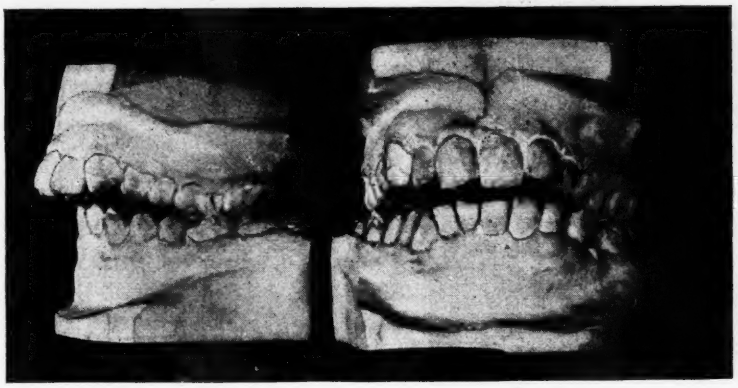

Fig. 17

whether the case is not in a worse condition than it was before treatment was begun.

A few of these results would soon lead one to believe that the general public would be much better if the general practitioner of dentistry did not attempt the correction of malocclusion. Not only are the treatments instigated

by general practitioners very unsatisfactory, but in a great many instances even the advice given to prospective patients is of the worst character.

Fig. 18 shows the models of a girl nineteen years old who had a bad open bite besides the complete distal occlusion of the lower arch. The mother of this patient had been advised by three different dentists to have the molars extracted even though the canines are not yet in position. It would be very easy to imagine the undesired facial result that would have been obtained had this kind of treatment been followed, besides the extreme malocclusion that would have developed.

Fig. 18.

Fig. 19-*A*.

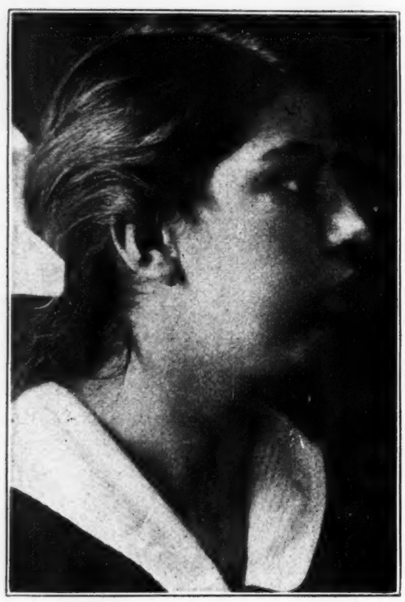

Fig. 19-*B*.

Figs. 19, A and B, are the patient's face, and by a study of the face, one realizes that the underdeveloped mandible should be increased in size if possible, the upper arch widened so as to produce normal breathing and, in fact, a plan of orthodontic treatment pursued which would be far different from that advised by the general practitioner of dentistry. The greater number of these

cases we see the more we are impressed with the fact that the general practitioner of dentistry should receive education in the basic principles of orthodontic treatment so that he will be able to advise his patients intelligently and prevent some of the unfortunate occurrences that have taken place in the past.

Figs. 20 and 21 show the father of two of my little patients who has been the victim of improper orthodontic treatment. His teeth were irregular when a child; and when a young man, he went to his dentist, who straightened them. The result of this straightening procedure can be very easily seen by examining the face. While he was a young man, his facial development would suggest that he was somewhere in the neighborhood of fifty. The underdeveloped condition of the mouth, the receding chin, all speak of improper orthodontic treatment in the hands of general practitioners. Fortunately, this man realized he had not received the proper treatment and, therefore, avoided having his children fall into the hands of someone and receive such treatment as he did.

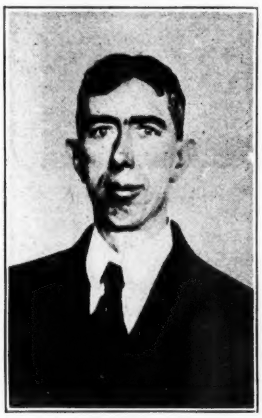

Fig. 20.

Fig 21.

Fig. 22 shows models from a little girl's mouth, while Fig. 23 is a child's face. It is very easy to see that if she received the same plan of treatment her father did the facial deformity would be very great. However, with the proper plan of treatment and proper forces applied upon the teeth the teeth can be made to assume a proper position, and the face, a normal development. Not only does the patient suffer from improper orthodontic treatment at the hands of the general practitioner, but some of the results obtained by general practitioners are judged to be the proper or only kind of orthodontic results that can be obtained. Very recently a surgeon came to me with the question as to whether the correction of malocclusion could not produce enlargement of the submaxillary glands. I told him I had never seen such conditions occur. I was asked to examine two children who had been in the hands of a general practitioner undergoing orthodontic treatment, and found the lower molars very badly infected, and in fact all of the alveolar process absorbed around them. The result of the absorption of the alveolar process on the four permanent molars had been produced by improper stress from regulating appliances and consequently the resulting infection and irritation had traveled to the submaxillary glands. It is also very probable that the use of wire ligatures had been allowed

to infringe upon the peridental membrane of the premolars, which had also produced infection with the result that the entire oral cavity was in very bad shape. Consequently, medical men who had not seen proper orthodontic treatment were inclined to judge all orthodontic results by the unfavorable result which they had seen produced by the general practitioner of dentistry. Consequently, in this case not only did the patient suffer, but the entire orthodontic profession suffered from the incompetent treatment of the case in the hands of the man who knew nothing about the basic principles of orthodontics. Other physicians have told me of thyroid glands becoming so badly infected that they had to remove them while the dentists were straightening irregular teeth. I

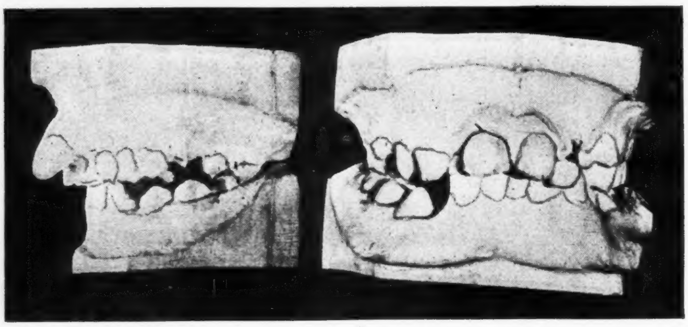

Fig. 22.

Fig. 23.

also know of two young ladies, aged, respectively, eighteen and twenty-one, who had bad cases of malocclusion and the dentist put the anterior teeth in each case in somewhat acceptable shape in three months' time. Afterward radiographs proved pyorrhea or something else had absorbed the process of all the anterior teeth. In each case another dentist extracted eight teeth for the young ladies. Therefore, as a result of this, the information becomes prevalent among the public that orthodontic work is a failure, that teeth loosen and come out after being regulated and again orthodontia receives unfavorable comment because it is practiced by men who know nothing about the subject.

As the result of these unfortunate conditions which I have cited to you,

I am forced to adopt the opinion that general practitioners should do very little orthodontia, if any, and that we, as orthodontists, should exert every effort possible in educating the dental profession along this line, and causing them to realize the importance of this work so they will not attempt something they are not familiar with. It has been my experience that the general practitioner who knows the most about orthodontia is the man who attempts to treat the fewer cases. If the general practitioner realized the importance of malocclusion and the histology of the tissues supporting the teeth, the possibility of normal development, and the danger of improper stress, he would be a much more valuable man in the support of orthodontia than the man who knows nothing whatsoever. Therefore, I believe that the best thing the orthodontist can do for his own salvation is to properly educate the dental profession along orthodontic lines until they realize the importance of the work and realize that "a little knowledge is a dangerous thing" and unless the case is properly handled, a large amount of unsatisfactory results will occur, which not only has a bad effect on the general practitioner himself, but on orthodontia and dentistry as a whole.

THE IMPORTANCE OF THE APPLICATION OF THE LABIAL ALIGNMENT WIRE

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

WITH the advance of various new types of regulating appliances, including the pin and tube appliance, the ribbon arch, the Robinson appliance, and various other appliances with different attachments and designs for the purpose of bodily tooth movement, a great many men have recognized the fact that the principle employed in all of these styles of regulating appliances dates back to plain alignment wires. Because of the great amount of benefits and results claimed to be obtainable by these so-called new styles of appliances, a great many men have believed that the labial alignment wire is out of date, and consequently should not be taught or considered. The question was recently asked me by a man who is foremost in the orthodontic profession, whether we still taught our students in college the use of the plain expansion arch, as he called it, or the labial alignment wire. When informed such was the case, he immediately expressed the opinion that we were out of date because we did not confine ourselves to the newer forms of appliances. I believe that it does not make any difference what style of appliance is used, but in order to work any of these newly patented appliances it is necessary to have some knowledge of the basic principles as illustrated in the old style expansion arch.

It has been stated that every tooth movement is accomplished by pulling or pushing, which is true, and often has been stated that for every action there is an equal reaction. This is true with any appliance regardless of the kind used. I do not see how it is possible for a man to successfully employ any of the new style appliances, whether it be the labial or the lingual appliance, unless he is familiar with the mechanical principles involved in the old style expansion arch, which is better termed an alignment wire. It is also because of the fact that I have seen some very deplorable results produced by the improper adjustment of alignment wire and the regulating appliances that I am calling attention to the importance and necessity of the proper appreciation of the principles employed in the alignment wire in order not to produce untold harm.

In considering the alignment wire, or expansion arch, such as is shown in Fig. 1, one must remember that the alignment wire embodies the principle of the spring lever and the screw. The alignment wire should be divided into two parts, representing the incisor and canine section, which may, in the majority of cases, be considered the spring portion of the alignment wire. The posterior portion extending back from the bend in the canine region may be considered the heel of the arch, or the threaded portion, which may have an active spring or which may be inactive. It is because of the fact that this posterior heel of the arch may be inactive or active that we are able to accomplish certain results, and it is also because of this spring in the posterior heel of the arch that we see in some instances undesirable results. It must be remembered that as the alignment wire possesses a certain amount of spring, the posterior end of the alignment wire must bear a certain definite relation to the tube on the molar band or

change will occur in the molar region. One must also realize regardless of what position the alignment wire assumes when placed in the tube, that it is naturally going to move the attachment to a point where the alignment wire will become absolutely passive. It is the failure to recognize the continual action of the spring force of the alignment wire that is responsible for a great many of the unsatisfactory and undesirable results, amounting almost to criminal neglect, that we see in some cases under treatment. It must be remembered that the screw section on the alignment wire is to be used primarily for bringing the anterior teeth forward and is not to be used as a means of increasing the expansion of the dental arch.

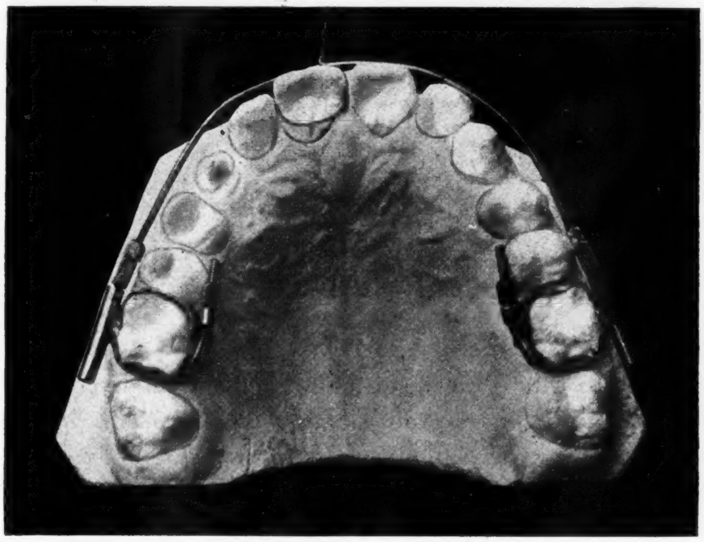

Fig. 1.

I have seen a number of unfavorable results produced because men have attempted to expand dental arches by lengthening the lateral halves of the alignment wire by the use of the nut. Such a procedure always results in failure, and the expansion of the dental arch is long and narrow, or there is a forcing distobuccally of the anchor teeth. The great possibility of a distobuccal movement of the anchor teeth when the alignment wire is being used was called to the attention of the profession several years ago by Dr. Barnes, of Cleveland. If, in adjusting the alignment wire, it is desired to produce an expansion of the molar region without the rotation of the molars, care must be taken to see that the alignment wire lies parallel to the tooth on the molar band when the alignment wire is in a state of rest. (Fig. 2.) A great many cases are seen in which the alignment wire has been placed in a tube on the molar band, not occupying a parallel position to the molar; the molar has necessarily been rotated into an unfavorable position. In certain cases it is desirable to rotate the molar, which can be easily accomplished by having a definite position between the tube and the alignment wire. The adjustment of the alignment wire as seen on the left side in Fig. 3 is such as will produce a buccal rotation of the mesio-buccal angle of the lower molar. This style of rotation would be more efficient if a plain band were used instead of the clasp band, as there would be nothing irritating

on the lingual side of the band. In order for the mesio-buccal angle of the molar to rotate with the clasp band, the screw must necessarily stand away from the second premolar as shown in Fig. 3, which would be more or less irritating to the tongue.

Fig. 2.

If it is desired to rotate the distal angle of a molar buccally, the same can be produced by so adjusting the alignment wire as shown in Fig. 4. Fig. 5 shows an adjustment of the alignment wire, which rotates the mesio-buccal angle of the molar lingually. These adjustments of alignment wire are by no

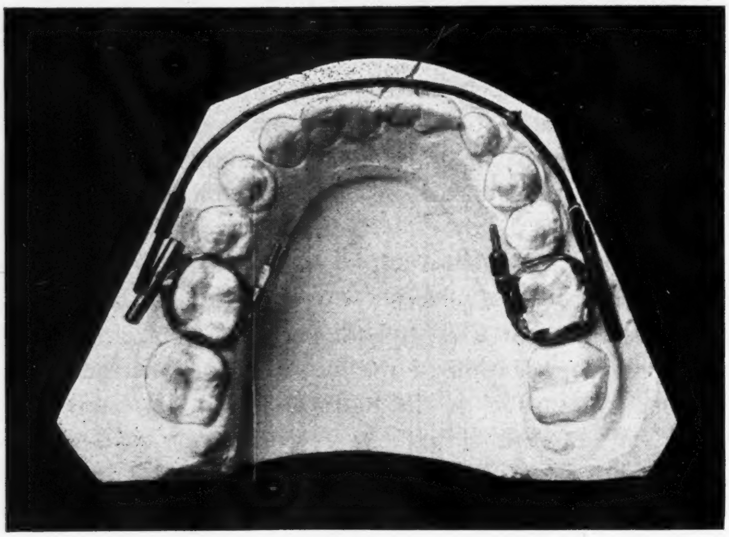

Fig. 3.

means new, and they have been called to the attention of the profession a great many times and are here given again simply because of the numerous cases which have been called to my attention recently where men have failed to recognize this phase of alignment wire adjustment. I have called attention to the

fact that the alignment wire embodies the spring force and have also stated that the spring force can be obtained from the posterior heels or a section of the arch, which adjustment is not very well understood by many men attempting to use the alignment wire. The adjustment of the alignment wire to shift the

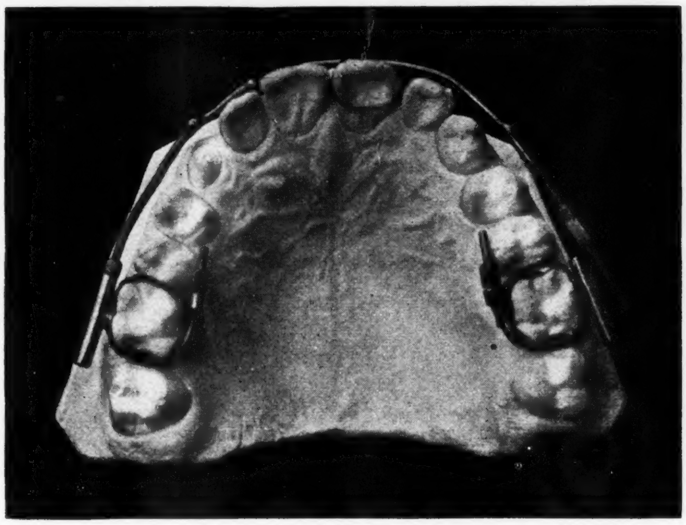

Fig. 4.

median line of the arch in such a case as is shown in Fig. 6 is not well understood. In fact, the majority of men undertake to shift the median line of the arch in such cases by the use of the threaded portion of the alignment wire, which produces an undesirable movement of the anterior teeth. As the median

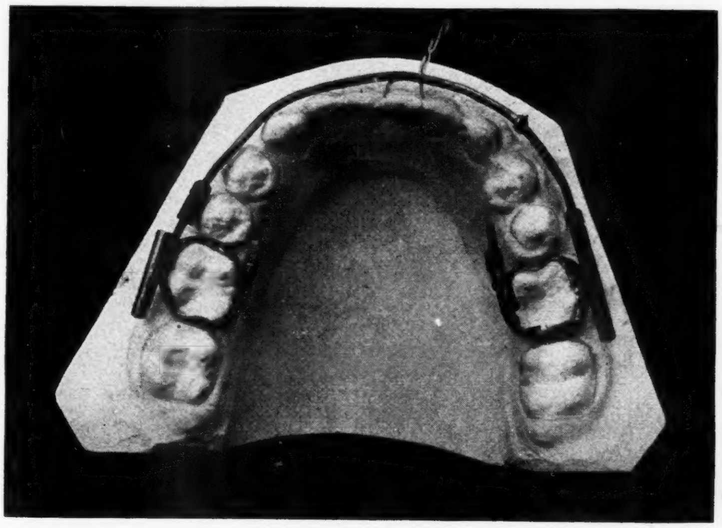

Fig. 5.

side of the upper arch needs to be shifted to the right, the alignment wire should be adjusted as is shown in Fig. 7. It will be seen that the alignment wire hugs the teeth closely on the left side, stands away from them on the right, and carries lugs for the purpose of receiving wire ligatures. While the method of at-

taching to the anterior teeth may be one of personal selection, it makes very little difference what style of attachment is used; for in order to get the necessary movement, the alignment wire must be so adjusted as to give the spring

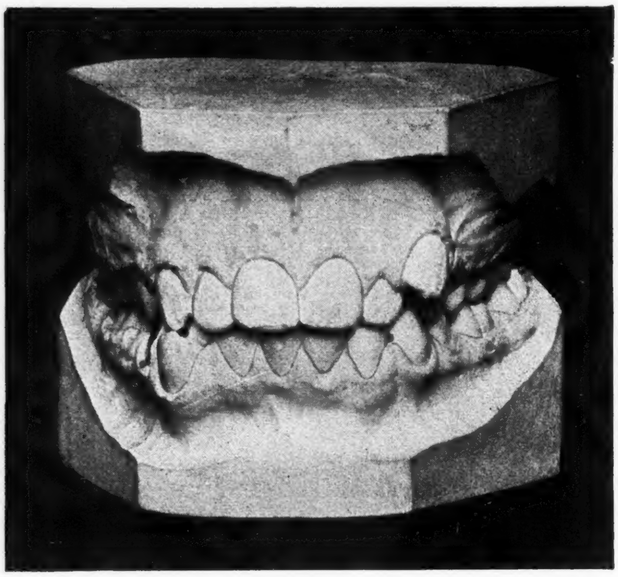

Fig. 6.

shown in Fig. 7 and 8. In this case the spring will shift the median line of the arch in the lateral half of the posterior heel of the alignment wire and, therefore, when the alignment wire is sprung into position as shown in Fig. 8 from Fig. 7,

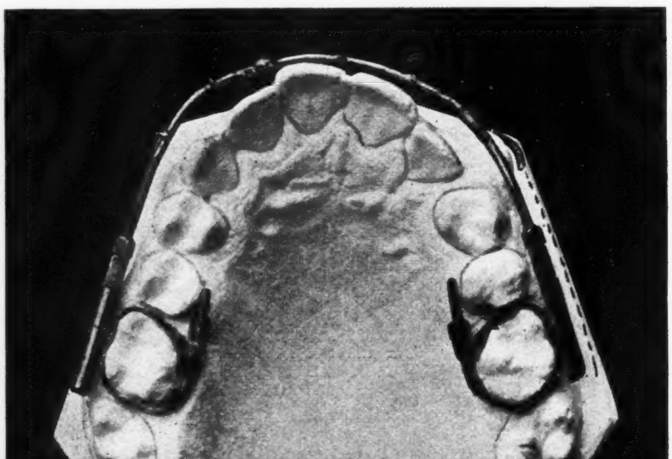

Fig. 7.

a force drawing the upper anterior teeth to the right is obtained which is very effective in shifting the median line.

It must be remembered that the labial alignment wire, or, in fact, any style

of appliance that is used embodying a spring is an active force, and will continue to act until the teeth are moved into such a position that the appliance is absolutely passive. It must also be remembered that anchor teeth, if subjected to a lateral stress or a stress of torsoversion, will be changed in their position and shifted as the result of the force of the alignment wire. It is because so many

Fig. 8.

men are attempting to use complicated regulating appliances before they have mastered the mechanical principles of a simple alignment wire that I am calling attention to these facts for I am aware that a great many unsatisfactory results are produced in different parts of the country by men attempting to use appliances before they are versed in mechanical principles.

THE LABIAL ARCH WITH SPRING EXTENSION AS USED BY DR. LLOYD S. LOURIE

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

IN Vol. II, No. 10, of the Journal is an article describing the lingual arch in combination with the labial arch with extension as used by Dr. Lloyd S. Lourie, in which Fig. 1 is shown as Fig. 12. Fig. 1 shows the labial arch with

Fig. 1.

the spring extension, but a description of the advantage of those spring extensions as used by Lourie is not given in that article. In order to illustrate more completely the advantage of the spring extension the following is published.

Fig. 2.

The spring extensions are designed primarily to be used in the movement of the teeth bodily, or otherwise, and are used in such a manner as to also control rotation or torsoversion. Fig. 2 shows the occlusal view of an upper arch in which it is necessary to produce considerable movement of the lateral incisors, also an apical movement and a rotation. In selecting appliances it was decided that the labial arch with a spring extension would be better suited to the needs of the case and more nearly fill the physiologic and mechanical requirements of a good regulating appliance than any other style of appliance that could be used.

Fig. 4 is a view of the left side of the upper arch, in which the appliance on the case as made from a study model is shown. It will be seen that the lateral incisors carry a band which supports a small perpendicular tube. The

labial arch is a 17-gauge gold and platinum arch which was bent gingivally sufficiently far to lie entirely above the gingival border of the gum tissue. The object of an arch in this position is to make it less conspicuous and also to make it possible to use a labial spring extension spur of considerable length. The reason for using a labial spring extension spur of considerable length is to give an independent elasticity in the spur without disturbing the rest of the labial arch. The spur as used in this case was 22-gauge gold and platinum or elastic gold, but 24-gauge would more nearly fill the physiologic requirements because it would give an elastic spring which makes possible the exertion of

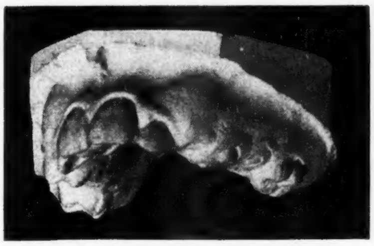

Fig. 3.

Fig. 4.

force upon a lateral incisor without disturbing any portion of the labial wire.

By comparing Fig. 3 with Fig. 4 it will be seen how the lateral incisor has been moved to its proper position both as regards the movement of the apex, which can be judged by the position of the crown, and also the manner in which it has been rotated. Pressure was brought to bear upon the canine which assumed a prominent position by means of a spring extension which was soldered on the labial wire in front of the molar tooth. This labial extension to the

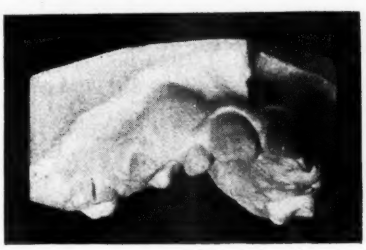

Fig. 5.

Fig. 6.

canine was made long to provide an elasticity without disturbing any other part of the appliance. The upper left central incisor was slightly prominent which was reduced by means of a spring extension as shown in Fig. 4 which rests against the central.

This spring extension is tapered towards the occlusal which gives a greater spring or elasticity at the occlusal border and also prevents a displacement of the labial wire to the extent that would occur if the spur were the same size. Also the tapering of the labial spur renders the spur or extension less conspicuous in that it is the same diameter all the way from the gingival to the occlusal surface.

Fig. 5 shows the right side of the same case in which the position of the

right lateral also indicates the necessity of an apical movement, as well as a rotation. The band with the perpendicular tube was placed on the lateral and the same type of spring extension spur as used on the left side was also employed. By using the spring extension, shaped in a letter J, it makes possible a two-point contact on the labial surface of the tooth whereby rotation can be accomplished. The right canine needs mechanical assistance in order to help it assume its position, and this is accomplished by placing a band upon the tooth, carrying a small spur which can be seen in Fig. 6. A spring extension from the labial arch is caught on the spur and thereby exerts an occlusal force on the canine without disturbing the major portion of the labial arch.

The extent of the tooth movement is shown by comparing Fig. 7 with Fig. 2 which especially calls attention to the manner in which the lateral incisors have been rotated by the spring extension. The advantage of these spring extensions is that the long spring gives a great range of elasticity and makes

Fig. 7.

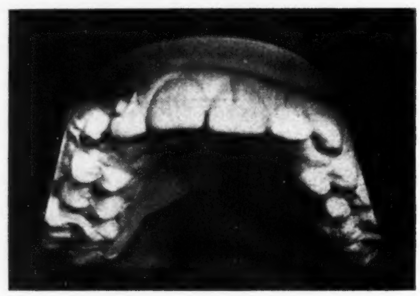

Fig. 8.

possible pressure upon the individual teeth without disturbing the labial arch. In order for this individual pressure to be possible, however, the extension spring must be of a small gauge. The advantage of placing the arch labially under the lip renders the appliance less conspicuous as shown in Fig. 8 which represents practically as much of the teeth as would show in the mouth. It will be seen that the entire tooth and the gingival border of the gum tissue can be exposed to view without the main labial wire showing. The only part of the appliance on the incisors which shows is the extension spur on the central, and the bands on the lateral incisors with the occlusal portion of the spring extension. As a result of this, the appliance is much less conspicuous than any other appliance used for similar tooth movements and it accomplishes the movement much more satisfactorily owing to the long range of elasticity and the independent adjustment which is possible in the spur extension.

THE THIRD MOLARS IN RELATION TO MALOCCLUSION

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

THERE is probably no problem in the dental profession today, which has been the cause of so much discussion or which has led to such a variety of statements from every viewpoint as has that of the third molars. If the question is considered from a purely dental standpoint, one will find men who advocate that every third molar should be extracted as soon as possible, and others who are equally as positive that every third molar should be retained as long as possible. These are men who claim that the third molar has no possible use, and there are men who claim the third molar has a great use. Some claim it is only a source of annoyance, while others claim that it performs a very important function. The probabilities are that both are right in some instances, and that in no case will the same rule apply to all conditions.

We have seen the mouths of individuals that undoubtedly would be better off if the third molars were extracted, and we have also seen mouths in which the dental apparatus has been mutilated, the efficiency of which has been reduced by the extraction of the third molar. Therefore, like a great many other problems in life, this can not be solved the same way in all cases. There is no question but that in the mouths of a great many individuals the third molars perform very important functions during the life of the individual, during the time all of the molars are retained, and in a great many instances, serve as attachments for artificial substitutes which could not be employed if the third molars were lost. In other mouths, we have found that just the reverse is true; that the third molar has not only been a source of considerable irritation, owing to the fact that it has not sufficient room in which to erupt, but it has also been a detrimental factor to the remaining teeth, and especially to the second molar.

There is probably no tooth in the mouth, unless possibly the first molar, which has such an unfavorable environment to contend with as does the third molar. The tooth extends over a long period of development and is influenced by environment to a great extent. In fact, most of the troubles which the third molars cause today are the result of the environment under which the tooth is forced to erupt. If man lived the same today as he did years ago, when the third molar had a positive function, these teeth, in all instances, would perform valuable functions today. It is a known fact that man is not living the same as he formerly did, and environment has produced changes in the dental apparatus, as a result of which the third molar probably suffers as much as any tooth. We are also aware of the fact that it is a law in Nature that the organs have a tendency to reassert themselves even after their usefulness is lost. This is true in a great many instances with the third molar. In other words, we will find individuals who develop a normal dental apparatus in which there is sufficient room for all of the teeth except the third molar and still the third molar will persist in developing. There then will be one of two things occur. The third molar will become impacted because of lack of room behind the second molar, producing a series of inflammatory disturbances or patho-

logic conditions, or it will assert itself and under the stimulation of growth will make room for itself by crowding or causing the other teeth to travel forward, resulting in a bunched condition somewhere in the anterior teeth. The question as to what effect the third molars have on the dental apparatus has been asked a great many times by the dental profession and by a number of orthodontists.

For a number of years the orthodontic profession was divided in regard to the effect of the third molars upon the existing anterior teeth. Some men claimed that the eruption of the third molar produced bunching in the incisor region while others contended that an erupting third molar would not have sufficient force to change the position of the teeth, to cause a drifting of the teeth, and, therefore, the only effect that would occur would be an inflammatory condition or an impacted third molar. Both of these conditions have probably existed in some cases, in fact, we are sure they have. At the present time, the question can be answered both ways. In some instances, the erupting third molars, or the third molars in attempting to erupt simply meet with an interference which causes an impaction with the second molar and cause pathologic conditions which are limited to the region of the third molar or to nervous reflexes. In other instances the erupting third molars will crowd the anterior teeth forward, causing a bunching either in the premolar or incisor region. In the majority of instances, the bunching occurs in the incisor region owing to the fact that the incisors are held in the line of the arch only by proximal contact. If a sufficient force be exerted on the posterior side of the dental arches, carrying the posterior teeth forward, some of the incisors will slip past the proximal contact point and consequently there will be a bunching. This condition has been observed in the practices of a number of men, and it has been observed in enough instances so that it may be considered a fact.

However, this is not a new observation, as we find in reading Weinberger's "History of Orthodontia" that he quotes from James Robertson who wrote in the *Dental Review, of London,* in 1859 on the "Cause of Irregularity of the Teeth" and mentioned the effect of the third molar upon the dental apparatus. Robertson says: "The growth and advent of the dens sapientiae, or third molars, when an insufficient space exists for its deevlopment is not only a source of great suffering, but frequently the immediate cause of irregularity by the pressure exerted toward the anterior teeth of the mouth which until their development presented a regular denture." We therefore find that James Robertson, in 1859, discovered that erupting third molars were a source of annoyance and were a direct etiologic factor in the production of malocclusion.

We find that the men who have been engaged in the practice of orthodontia for a number of years and who have been able to observe their cases during a considerable length of time have been impressed with the fact that erupting third molars very often produce malocclusion. In conversation with Lourie and Burrill who have observed their cases for a number of years they both are very emphatic in the statement that erupting third molars have been the cause of a large number of malocclusions occurring in dental apparatus which up to that time had remained normal. It is very probably true that a large number of so-called failures in the correction of malocclusion has been produced by erupting third molars. If this is true the orthodontic profession must meet this

problem squarely or they will be confronted with the question as to "what is the use of regulating teeth before the eruption of the third molar if the third molar is apt to produce malocclusion again."

If we are honest with our clientele and warn them that the erupting third molars are apt to produce malocclusion, it is well to discourage a great many people from having malocclusions treated at what we know to otherwise be the ideal time. Therefore, the manner and method in which to meet the problem of the third molar is that every case should be radiographed before treatment in order to determine the position, size, and location of the third molar. They should also be radiographed at various intervals or at times when they are expected to cause trouble, and if the radiograph and other anatomical conditions indicate that there is not sufficient room for the third molar, something then must be done to relieve the impacted condition of the third molar. Just what should be done will be a question of operative technic upon which men will differ and which condition will differ in different cases; but with our present knowledge of orthodontics and improved mechanical methods, as well as improved methods in oral surgery, there is no case of impacted third molars which can not be successfully handled. The diagnosis is made by use of the radiograph in such a manner as to prevent bunching of the anterior teeth and also leave the individual with good molar occlusion.

In some cases, owing to other clinical factors, it may be more desirable to extract the second molar and save the third, while in other cases it may be desirable to remove the third molar. I have seen cases where, owing to other clinical factors, the third molar would be a more desirable tooth to have in the mouth than the second molar. In this case I certainly would advise saving the third molar and sacrificing the second. In other instances, I would recommend the removal of the third molar; and because of this, each case must be diagnosed upon its merits and each line of treatment decided according to existing conditions. I have seen third molars which were caught under the distal convexity of the second and which otherwise were more perfect anatomical teeth than the second molars. In such instances, I think it would be better for the individual, both from the masticating standpoint and from the operative standpoint, to sacrifice the second molars and bring the third molars up into position. In other instances where the third molar is a deformed dwarf tooth, abnormal roots lying in abnormal position, the sacrifice of the third molar, even if quite an operative procedure, would be much more desirable than the sacrifice of the second molar.

We find another factor in regard to the third molar which seems to be quite hard to explain, but nevertheless it seems to be a clinical fact regardless of what causes the condition. It is this: that in a large number of cases, in fact, all that I have observed where the first molars for some reason have been lost early in life, the third molar is always a large, well-developed tooth. Now whether the loss of the first molar has anything to do with the increase in size and normal development of the third molar is a question that is very hard to prove, for it is impossible to extract a first molar and still retain it.

Some may say that the third molars and the dental arch would have been well developed if the first molars had not been lost. This, of course, one can

not disprove. However, we know that the calcification of the third molar begins with the cusp and for a considerable length of time the cusp is calcified, resting upon the dentine papilla without the cusp being united to the central fossa and the developmental groove. As a result of this, pressure is produced or exists in the region where the third molar is developing, it is very likely that the dentine papilla will not have sufficient energy or sufficient growth force to cause the crown to develop to the full size or to the size it would providing that impacted or crowded conditions did not exist. In the extraction of the first molar, the second molar invariably tips forward, relieving the impacted condition of the third molar, gives the cells of the dentine papilla a chance to expand and develop with the result that the enamel caps of the cusps are carried apart; the enamel organ is given more room, with the result that the crown of the tooth becomes larger; and if the crown of the tooth becomes larger, the pressure on the roots is relieved and the third molar is a normal, large, well-developed tooth.

Knowing this to be the fact and in the face of modern knowledge, that a great many first molars which are badly decayed do not have the roots properly developed, and properly filled, we often wonder whether it would not be more of a practical proposition from the standpoint of the patient, if some of these first molars had been extracted early in life and the proper orthodontic procedures instituted to bring the second molars into upright positions distal to the second premolars and allow the third molars to develop to their proper size and either come or be brought up against the distal surface of the second molars.

I believe in a great many mouths a much more satisfactory masticating apparatus would have developed if that plan had been followed than if the first molar had been retained as was the common practice a few years ago. I am not advocating the wholesale extraction of the first molars; but I do believe as a practical consideration that must be dealt with, there is a question as to what is going to be the most beneficial to the patient rather than what is going to be the ideal condition and result in the end. I believe the patient is much better off with two molars well developed and in an upright position, those two being a second and third molar, than they are with three molars, one of them being the first molar with badly filled roots, the roots probably not fully developed, and a third molar which is striving for room behind the second. As a result of this, the orthodontists today are confronted with a problem in which their plan of treatment will have to be modified to meet existing conditions much more practically than it has in times past.

In beginning the treatment of a case of malocclusion at the age of seven, or, in fact, at any age, radiographs should be made of all the teeth to determine the condition of the roots of all the permanent and deciduous teeth and also radiographs to show the possible position of the upper and lower third molars. As the treatment progresses at various intervals, and during the early life of the individual, the case should be kept under observation and radiographs made at various periods to determine the progress of the eruption of the third molars. The time of retention or the length of mechanical retention will depend upon the manner in which the third molars are erupting. I believe that it is extremely

unsafe to take off retaining appliances on the lower anterior teeth at the time the third molars are erupting unless the radiograph reveals there is sufficient space for the third molar to erupt without any tendency to forcing the second and first molars, or the dental apparatus forward. If the third molar is only slightly impacted, it may be relieved or assisted to erupt by various mechanical devices, one of which is the ligature jack which was described by Lourie several years ago. If the radiograph reveals that there is absolutely insufficient room for the tooth, then there is a question of deciding some plan of treatment to make room which will invariably include the extraction of some tooth in the molar series. What tooth that is, will depend upon other conditions that exist in the individual and that can not be governed by any set rule.

However, the fact remains that the third molar is a factor in the production of malocclusion and it can be made a factor in the production of an efficient set of teeth and as a result of this must receive a great deal more attention than it has in times past.

Get Busy

Ye editor sat in his busy den,
Cussing, and saying, "I wonder when
The fellows who read my monthly screed
Will come to my rescue with word or deed.

"I'm working for them, and it should be WE.
Why should they all lay down on me?
Our interest is a common one,
But the toil is mine, and theirs the fun.

"Come, wake up, boys, don't be so slow,
For this magazine has got to go.
Give us an item, now and then,
From your active brain and your facile pen.

"This is not an organ filled with 'guff,'
With nothing but advertising stuff.
Give us your thoughts and experience, too,
That others who follow may learn from you,

"Of your trials great, and your triumphs grand,
From coast to coast in this favored land.
So now get busy. Come off the shelf,
For by helping others you help yourself."

—Charles H. Requa.

THE PRINCIPLES INVOLVED IN THE ECONOMIC READJUSTMENT OF DIETARIES*

By J. J. R. Macleod, M.B., Cleveland, Ohio.

THE basic standard of diet is its energy value. The energy value of the foodstuffs is the currency of dietetics. Just as in the barter and trade of commerce some common basis of exchange is necessary, something, that is to say, having a standard value with which the value of all other things can be compared, and by the use of which they can be bought and sold; so with food, in order to exchange one foodstuff for another in the dietary, some standard of relative values—some food currency—must be used. The basis of monetary currency is the dollar; that of food is the calorie.

This does not necessarily mean that the calorie, although itself a fixed value, is always of exactly the same dietetic importance, for just as in the monetary system the purchasing power of the gold dollar may vary in different countries, so in dietetics may the relative importance of the calorie vary with the foodstuff which supplies it. Thus, the ration of one individual may be quite inadequate or may be harmful for another. "Ae man's meat's anither man's poison." Quite apart from gratification of appetite, which, however, is a most important factor in food assimilation, the food consumed by each individual must be properly adjusted to meet his peculiar requirements. Besides its caloric value, therefore, certain other values for foods must be taken into consideration, but at the outset attention is called to the calorie.

A calorie is the unit of energy. It can be used to measure the expenditure of energy, whether this occurs as heat, or as mechanical work, or as electrical discharge, or as chemical reaction. To make this plain, consider the relationship between the expenditure of energy as motion and as heat in the case of a steam engine. When the engine is at rest, all the energy is dissipated as heat, but when it works, some of this heat takes the form of movement, the sum total of energy expenditure being the same whether the engine is standing still or is moving. The source of the energy given out by the engine is obviously the fuel which is burned in the furnace. Turning now to the animal body, the fuel which it burns is the food. Everything capable of burning outside the body is not suitable for the animal fuel, but only those substances which can be acted on by special types of reagents present in the animal, called enzymes or ferments, which have the function of loosening up and breaking apart into smaller molecules the large complex molecules of which food is composed. The smaller molecules then unite with the oxygen of the blood and become burned or oxidized and liberate their energy. The foods belong to three classes of organic substances: fats, carbohydrates, and proteins.

In order to find out how much energy is available in a fuel, it is necessary to burn it and measure the amount of heat which it gives out in the process. The measurement of the amount of heat is not, however, so very easy a matter

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to comprehend. It is not a question merely of increase in temperature, for it is obvious that there must be very different *amounts* of heat in an ounce and in a pint of boiling water; placed side by side in similar vessels the ounce of water will cool off much more quickly than the pint. This simple example indicates a basis upon which we may measure heat, namely, as the temperature multiplied by the volume or mass of water. The unit of such measurement is called a calorie, which is defined as the amount of heat required to raise the temperature of 1 kg. of water (2¼ lb.) through 1°. C., or, roughly, 1 lb. H_2O, 4°F. In order to measure the caloric value of a fuel or foodstuff, we must, therefore, ascertain the degrees of temperature through which a known volume of water is raised by burning a weighed amount of substance in such a way that all the heat which it gives out is taken up by the water.

The apparatus for doing this is called a calorimeter, which consists, in principle, of a stout iron chamber, or bomb, into which a weighed amount of the fuel, or food, is placed and then filled with compressed oxygen. The bomb is tightly closed, placed in an outer vessel containing a known volume of water at a known temperature, and the fuel or food set on fire by an electric current. When 1 gm. (15 gr.) quantities of each of the three foodstuffs are burned in the calorimeter, the values are: protein, about 5.5; fat, 9.3; carbohydrate, 4.1. That means, in the case of fat, for example, that if 1 gm. be burned in the chamber of a calorimeter, which, it will be assumed, contains 1000 gr. water, an increase of temperature amounting to 9.3° C. will be observed. No matter how slowly or quickly the given material burns, the caloric value is always the same.

To compute the total energy taken into the body, all we have to do is to weigh each article of food, ascertain from the numerous dietary tables readily available in textbooks, encyclopedias, government bulletins, etc., how much fat, protein and carbohydrate it contains, and then multiply each of these by its proper caloric value and add the results together. This gives us the caloric value available when the foodstuffs are completely burned. But some of the food is not entirely oxidized in the animal body, so that to determine the physiologic caloric value, we must subtract from the crude value the caloric value of the unused portion given out with the excreta. In the case of fats and most carbohydrates, the subtraction is very small if digestion and assimilation be in good order. It is considerable, however, in the case of protein, bringing the actual caloric value of this foodstuff down to 4.1, the same as for carbohydrates.

So far we have gone on the assumption that the caloric value of the foods will be the same whether they are quickly burned or only slowly used up in the life processes of the animal body. Obviously, however, before dietetics can be considered to rest on any scientific basis, indisputable evidence that such is really the case, must be furnished. The energy output of animals must be measured to show that it balances up exactly with the energy value of the food which has meanwhile been consumed. One of the greatest accomplishments of modern physiologic science is the fact that it should have been possible to do this very thing. For this purpose a calorimeter is again used, but modified so that it may be constantly ventilated to prevent suffocation of the animal. This is called a respiration calorimeter. It consists of an air-tight

chamber with double walls, in the space between which is an ingenious device by which the temperature of the air of the space is regulated so as to be exactly the same as that of the chamber itself, thus preventing entirely any loss of heat. The heat given off by an animal placed in the calorimeter is measured by observing the change in temperature produced in a known volume of water passed through radiators in the chamber, that which is meanwhile employed to evaporate the water given out in the expired air and sweat being readily computed by collecting this vapor in suitable absorption bottles (see p. 746) placed in the course of the ventilating tubes. Calorimeters have been constructed by Atwater, Benedict and Graham Lusk, in which a man can live comfortably for long periods of time.

The above comparison can not be made by merely measuring the food the animal eats, because the food is not necessarily consumed immediately after it is taken; it must first of all become assimilated in the body, and this takes some time. Months indeed may elapse between the time that a food is eaten and that when it is ultimately oxidized to yield energy. It is on this account that a starving animal may go on yielding energy; he lives on the foodstuffs which have been incorporated with his body; he feeds on his own tissues. The problem is not so simple as in the case of a steam engine, where we may compare the energy output with the fuel consumption.

How, then, is it known that each of the foodstuffs gives out as heat and other forms of energy the same amount of heat which it produces when burned in a calorimeter? The rate at which combustion is proceeding in the body must be measured by measuring the products of the combustion.

To understand properly the principle upon which such a measurement depends, turn for a moment to the conditions obtaining when a piece of sugar or fat is burned outside the body. As the combustion proceeds, carbonic acid and water are given off because of the union of the oxygen of the air with the carbon and hydrogen, of which elements, along with some intramolecular oxygen, either of these foodstuffs is composed. By the oxidation, energy is liberated as heat, so that the number of calories given out by the burning process is directly proportional to the amount of water and carbon dioxide meanwhile produced and the amount of oxygen used up. It is, chemically, a comparatively easy matter to measure the amounts of these combustion products. The carbonic acid is measured by finding how much alkali it can change into carbonate and by leading the air which contains it as vapor through substances, such as concentrated H_2SO_4, which absorb it. The analysis of proteins is more complicated on account of the fact that, besides carbon, hydrogen, and oxygen, they contain nitrogen. By suitable chemical processes this nitrogen has either to be dislodged from them, or converted into its hydrogen compound, ammonia, which is then very easily measured.

Let us see now how these methods of the chemist may be employed to measure the products of combustion in the case of an animal. For this purpose the chamber of the calorimeter is connected with an air-tight system of wide-bore tubes, along which an air current is made to circulate by means of a rotary blower or fan. The water and carbon dioxide given off by the animal are caught in so-called absorption bottles, inserted in the system and containing

suitable reagents to combine with the gases. The oxygen consumed by the process of combustion causes the volume of air in the system to shrink, but just as quickly as it does so, as indicated by a gauge, fresh oxygen is discharged into the system from a cylinder of the gas. In a chemical analysis, as we stated above, the water value, as well as that of carbon dioxide, is used in calculating the composition of the substance burned. In a metabolism experiment, however, as the above physiologic method is called, the water excretion is not of much value as a means of determining the amount of combustion, because of the fact that relatively large and inconstant amounts of it are taken with the food, and the body at different times contains varying amounts of it. The carbon dioxide excretion, taken along with the oxygen intake, is the important criterion. In short, then, by measuring the carbon dioxide absorbed by the absorption bottles and the fresh oxygen that has to be delivered into the system to keep the volume constant, one can tell exactly how much material containing carbon and hydrogen is being oxidized in the body.

When we know how much carbon has been oxidized, we can not tell how much of it came from protein, fat, or carbohydrate, because all three contain it; and the energy value of each being different, we can not compute how many calories have *in toto* been liberated by the combustion process. To find out what foodstuff was actually consumed, some other excretory product that is peculiar to one or the other of the foodstuffs must be observed. In the case of protein, this is made possible by the fact that the amount of nitrogen which the animal excretes during his stay in the chamber can readily be measured. Having found from the nitrogen excretion how much protein must have become used up (by multiplying grams of nitrogen by 6.25), we may then calculate the amount of carbon contained in this amount of protein and substract it from the total carbon which must have been burnt to produce the carbon dioxide. The remainder is the carbon of the fat and carbohydrate that have been burnt. The relative amounts of these two can then be computed from a knowledge of the relationship of the oxygen absorption to the carbon dioxide excretion—the so-called respiratory quotient.

Having thus become acquainted with the general principles of which the necessary measurements are made, the results are next to be considered. These are among the greatest achievements of modern medical science, for when the measurements are properly made, the caloric output as directly measured corresponds exactly with that calculated by multiplying the amount of each foodstuff, known to have been burned in the body, by its caloric value. This accurate correspondence of the *direct* and *indirect* methods of calorimetry has both a practical and a theoretic interest. It shows, for one thing, that there can be no energy either created or lost in the animal body that is not accounted for by the oxidation of the foodstuffs. It shows that no energy can be absorbed from the outside or new forms of energy created in the animal body. It proves the law of the conservation of energy for the animal mechanism.

And now with regard to the application of these extremely important facts in the science of *dietetics*. We are in a position to determine with scientific accuracy just exactly *how much food should be taken under varying conditions of bodily activity*. In a general way, we know that the amount of food that is

required is proportional to the nature and amount of bodily exercise that is being performed at the time, and that, if the food supply is inadequate, the work before long will fall off, not only in quantity, but in quality as well. "Horses (and men) work best when they are well fed, and feed best when they are well worked," is an old adage and one the truth of which cannot be overestimated in the consideration of all questions of dietary requirements. An ill-fed beggar will rather suffer from the pain and misery of starvation than attempt to perform the piece of work that the well-meaning housewife bargains should be done before she gives him the meal. The spirit may be willing but the flesh weak. If he could be trusted, he should be fed first and worked afterwards. Besides the amount of work, two other factors are well known to influence the demand for food, namely, growth and climate. A young growing boy will often demand as much if not more food than would appear, from a comparison of his body weight with that of his seniors, to be his proper share, and, other things being equal, it is well known that we are inclined to partake much more heartily of food during the cold days of winter than during the sultry days of July and August.

That we know these facts, in a general way, indicates that the first steps in the exact determination of dietetic requirements must be to find out how much energy the body expends under varying conditions of activity, etc. It must be plain from what has already been said that this may be done by having the person live for some time in a respiration calorimeter, so that we may measure the caloric output by both the direct and the indirect methods, the results of the one serving as a check on those of the other. To the conclusions drawn from results of observations made under such artificial and unusual conditions of living, the objection might, quite justly, be raised that they need not apply to persons going about their ordinary routine of life. To meet this objection another method, which we may call the *statistical,* is available. This consists in taking the average diet of a large number of individuals and comparing its caloric value with the average amount and type of work that they are meanwhile called upon to perform. This can be done in cases where the diet is accurately known, as in public institutions, the army, the navy, etc. The total food supplied is then divided by the number of individuals, this giving the *per capita* consumption. Obviously some get more than others, but when a sufficient number of individuals is included, such errors become eliminated by the law of averages. The close agreement between the results secured by these two quite different methods is a guarantee of the reliability of either.

Before proceeding to consider the results in greater detail, it is plain that, in order to make it possible to compare the energy output of individuals of different sizes, the results, that is, the caloric output, must be determined for some standard size of body. If such a standard were not used but we merely quoted the results as so many calories given out during each hour or day, we should, of course, find that a small child gave out far less energy than a large full grown man; we should fail entirely to bring out the fact, which is of great significance, that relatively to the size of their bodies the child gives out considerably more energy than the adult. The standard usually employed is that of body weight, the kilogram (2¼ lb.) being the unit. During recent years, however, it has been claimed that a more accurate basis of comparison is the unit of body sur-

face, the square meter; but with the reasons for this change of standards and the controversial matters which have been raised in connection with them, we need not concern ourselves; for the purposes of a scientific study of the principles which govern dietary requirements, the body-weight standard is the most suitable to adopt at present.

Let us then consider the caloric output of a healthy man of average weight (70 kg.). In the first place, it must be measured while he is at perfect bodily rest, lying quietly in bed, and at such an interval of time after taking food that the digestive organs are inactive. This is done by having him sleep in a bed placed in the respiration calorimeter and measuring the caloric output the first thing in the morning when he awakes. Under such conditions it has been found that 1 C. per kg. per hour, or $1 \times 70 \times 24 = 1680$ C. per diem, is produced. At first sight this result would seem to indicate that food containing an amount of protein, fat and carbohydrate capable of yielding 1680 C. would meet the daily requirements, but such is not the case. More must be given to allow for the fact that the physiologic processes involved in the assimilation of food by the tissues, quite apart from anything else, causes some heat to be dissipated from the body. This property of food has been clumsily called its *specific dynamic action,* and it varies according to the nature of the foods, being largest in the case of protein and smallest in the case of carbohydrate. As a rough estimate, it is usually considered that the average daily diet has a specific dynamic value amounting to ten per cent of the resting caloric output, giving us therefore, for a resting man living on an average diet, a daily caloric output of $1680 + 186 = 1848$ C.

The further expenditure of calories depends entirely on the amount of muscular work done, and much interesting information has already been collected, showing just how many calories are set free in the performance of different types of work. It is significant that, with their far-sighted appreciation of the value of science in the welfare of the state, the German authorities should some years ago have appropriated considerable sums of money for just such investigations, and that the data should have served as one of their main guides in the apportionment of food to the people. The government, as soon as it saw the possibility of a shortage, placed the control of food in the hands of scientific food experts without permitting such a vital question to be trifled with by legislators whose knowledge of food values is as shallow as their knowledge of how to play obstructive politics is profound. The delay that has attended the passage through Congress of the bill for food control is all the more provoking when we consider that in our country, and ready to serve voluntarily, are men who have convincingly shown themselves to be second to none in the world, not only in the scientific knowledge which must guide, but also in the executive ability which must administer, an efficient food control.

It has been found that if the person instead of lying in bed be made to sit still in a chair in the calorimeter, his caloric output increases by about 8 per cent, and if besides this he be made to do such work as writing at a desk, it will increase by nearly 30 per cent. A little simple arithmetic thus shows us that for such work the caloric expenditure per hour while the man is doing such work will increase from 77, which we saw to be that of basal heat production and the specific dynamic action of the food, to 97 C.; and if he does such work for six-

teen hours and sleeps eight hours, this gives $8 \times 77 = 616 + 16 \times 97 = 1552 = 2168$ C. A great increase in caloric output is created by walking, even on the level, and it has been quite clearly shown that the difference between the value which we have arrived at, viz., 2170 C., and the actual caloric expenditure of 2500 C., which from statistical studies is known to be expended by individuals doing a light day's work, can readily be accounted for by the walking incidental to moving from place to place in the daily routine.

Coming now to the results of the statistical method, the reliability of this method is testified to by the remarkable correspondence in the caloric values of the food consumed by farmers in widely different communities:

	Calories
Farmers in Connecticut,	3,410
" " Vermont,	3,635
" " New York,	3,785
" " Mexico,	3,435
" " Italy,	3,565
" " Finland,	3.474
Average,	3,551

(Lusk: The Fundamental Basis of Nutrition)

The average inhabitant of various cities:

London,	2,665
Paris,	2,903
Munich,	3,014
Königsberg,	2,394

(Rubner)

Individuals in different callings:

Farmers' families (U. S. A.),	3,560
Mechanics' " "	3,605
Professional men's families (U. S. A.),	3,530
Army (U. S. A.),	3,851
Navy "	4,998

(Atwater)

In general it is usually computed that a man weighing 70 kg. requires in calories:

2,500 for a sedentery life.
3,000 for light muscular work.
3,500 for medium muscular work.
4,000 and upwards for very heavy toil.

(McKillop)

These figures apply to the average man, but in calculating the caloric requirements of a family or a community allowance must be made for the lesser requirements of women and children. Several dieticians have compiled tables showing how many calories are expended according to age and sex, and the German authorities have recently taken these figures from them and calculated a generalized mean, which shows in comparison with men the percentage that should be allowed for women and children. The figures are as follows:

Man,	100
Woman,	83
Boy over 16,	92
Boy, 14-16,	81
Girl, 14-16,	74
Child, 10-13,	64
Child, 6-9,	49
Child, 2-5,	36
Child, under 2,	23
	(McKillop)

In calculating the caloric requirement of the population as a whole, the necessity of making allowance for the varying needs of men, women and children would obviously make the calculations far too complicated for practical purposes. It is necessary to have a factor by which we may multiply the total population in order to determine its *man value*. This factor is based on the relative proportion of men to women and children, and it amounts very nearly to 0.75; i. e., three quarters of the total population gives "the man value." Knowing the total population, say, of a city, we must therefore multiply this by 0.75 in order to ascertain for how many men doing moderate muscular work (3000 C.) food has to be provided.

Although the first step in estimating the dietary requirements of a family or community is thus to ascertain how many calories are expended by each individual and then to find suitable foodstuffs that will supply this amount, it must not be imagined that we have thereby fulfilled all the conditions to be considered in drawing up a correct dietary. There are many other factors to consider, and these, for simplicity's sake, we may divide into two groups: first, those pertaining to the chemical nature of the foodstuff, and secondly, those pertaining to its palatability, digestibility, and availability.

To appreciate the importance of the *chemical nature of foods,* it will be well to return to the analogy of the animal body with a steam engine, not because we shall find that the analogy becomes any closer, but, because it so entirely breaks down in one important particular that it becomes of value on this very account. The fuel of the engine is fuel alone; it is used for no other purpose, whereas the food of an animal, besides being fuel, is also used to repair the tissues of the body which have become broken down on account of the constant wear and tear to which they are subjected in carrying on the processes of life. The next step is, therefore, to find out the relative importance of the foodstuffs in supplying material for the reparative processes in the tissues. Biochemical investigation has shown that these are composed of the same classes of chemical substances as the foods—proteins, fats, carbohydrates, salts, and water—and that proteins occupy the most important position, since the greater part of the living tissue is composed of them; namely, the cell and its nucleus. Some fats or fat-like substances are also associated with protein in the construction of this vital tissue machinery, but by far the greatest bulk of the fat found present in the body merely represents storage fuel deposited, not in, but between the really active or vital tissues. Some carbohydrate is also probably used to construct the machinery, but by far the greater proportion is used for fuel purposes; indeed, carbohydrate is the most readily available of all the foodstuffs for purposes of producing energy. There is no large store of carbohydrate in the body, because it

is quickly consumed, whereas fat may be stored away for some considerable time before it is ultimately used as fuel material. Standing distinctly apart from the others in dietetic importance, therefore, is protein. With this foodstuff alone, many animals can exist, although they may not thrive, whereas with fats and carbohydrates as the sole foodstuffs, life is impossible. Protein in the diet is a *sine qua non* of life, because it is more than a mere fuel: it is also the essential building material for the worn out tissues.

This unique position of proteins has, in a general way, been appreciated for many years, but, apart from the fact that, of all foodstuffs, proteins alone contain nitrogen, so little was known concerning their chemical structure that, with the exception of gelatin, all proteins were thought to be of much the same dietetic value. Thanks to the advancement of biochemical knowledge, it is now known that this view is very far from being correct, for proteins differ in their chemical structure and in their dietetic value. The differences are dependent upon the nature and proportions of the various groups of smaller molecules of which the highly complex and very large molecule of protein itself is composed. To make this clear, let us imagine the protein molecule as a completed building with its stone and lime, its woodwork and plumbing, its plaster, and so on. It is composed of a great variety of building materials; but in a row of buildings no two need be exactly alike (although the same materials in general are used in their construction); some of them may have no stonework, others no plumbing, and even in those which use all of the available materials, the relative quantities used will vary considerably. So with protein: it is built up of innumerable building materials belonging to the class of chemical substances known as amino acids, that is, organic acids whose acidity is practically neutralized by the inclusion in the molecule of an ammonia residue, called the amino group. There is a great variety of such amino acids, some comparatively simple and others highly complex, since they contain, besides the organic and amino group, other chemical groups that are often of highly intricate structure.

To know the name and structure of each of these protein building materials, or amino acids, is not necessary for our purpose here, but there are two or three that we must at least mention in order to be, later on, in a position to understand why certain proteins should be more valuable than others as foodstuffs. These are lysin, containing two ammonia groups; tyrosin and tryptophan, containing a so-called aromatic group; and cystin, containing sulphur. The protein of muscle, for example, is not composed of exactly the same variety and proportion of amino acids as that of egg white. Even the proteins of the same tissues of different animals may not be exactly the same in their amino-acid consistence. It is evident, then, that if, on account of wear and tear, the tissues should require certain amino acids with which to reconstruct their protein, the supply can be insured only provided the food contains proteins yielding these particular amino acids. In the process of digestion the proteins become broken down into the amino acids, which are then absorbed into the blood. The most perfect protein food would thus be one containing all of the amino acids found present in the proteins of all the tissues, for then each tissue could select from the blood the exact amount of each of the amino acids it required, and what one tissue did not require the others might make use of. In this manner all

of the amino acids of a protein foodstuff might theoretically be used as building material for worn out tissue protein; but such a perfect adjustment between supply and demand does not actually occur, there being always a surplus of some amino acids, just as there would surely be some building material unused from a wagon, initially filled with every variety, after it had supplied to each one of a row of houses the materials required for repair purposes. This rejected building material has to be got rid of from the body, and this is accomplished by the amino acid being split up into two parts, of which the one is burned to yield energy, and the other, consisting of ammonia, is excreted in the urine as urea.

The proteins that contain all of the essential amino acids, though in varying proportions, are those of animal origin, such as the casein of milk and the albumin and globulin of blood, eggs, and muscle. Certain vegetable proteins, such as are present in part at least in the soy bean, hemp seed, Brazil nut, maize, and wheat (glutenin), also contain all of the necessary amino acids, though not in such suitable proportions as in proteins of animal origin. These may be designated as vegetable proteins of the first quality. Other vegetable proteins, such as those of beans, peas (legumin), part of the protein of maize (zein) and wheat (gliadin), etc., on the other hand, are wanting in one or more essential amino acids and may be designated as of second quality.

These facts have been ascertained by actual chemical analysis of the proteins, and their relationship to the building up of tissue proteins has been demonstrated by observing the rate at which young animals grow when fed on different proteins. During growth it is plain that the building-up process in the tissues is occurring in exaggerated form, so that by observing the weights of the animals from day to day the rate of the process can be measured. It is no doubt the case that proteins which are inadequate for growth, will also be inadequate for the repair of broken-down tissues in the adult. By taking a piece of paper ruled in squares and placing the weights of the animals on the horizontal lines and the days of observation on the vertical, we obtain what is known as *the curve of growth.*

Many of the earliest observations were made on young rats and mice. To eliminate individual errors large numbers of the animals were used, all of them being fed on a uniform diet of carbohydrates, fats, and salts, to which was then added the particular protein whose influence on growth it was desired to investigate. Large numbers of animals were used in each group, so as to eliminate individual peculiarities and accidental errors. Fed on the basal diet alone, the animals did not live for more than a few days. If protein of animal origin, such as the casein of milk or the albumin of milk or egg, or blood were added, however, the curve of growth was exactly like that of a normal animal. The proportion of protein that had to be given to attain normal growth varied considerably in different animals. In the case of white mice 25 per cent of the total calories had to be given as protein; rats required 15 per cent, and man seems to need only 7 per cent, this being the proportion in human milk on which alone the human infant thrives. With vegetable proteins, such as the glutenin of wheat and maize (Indian corn), which contain all the amino acids, normal growth could also be secured, but more of the protein had to be given than was the case with animal proteins, because some of the amino acids are

not present in adequate amounts. With vegetable proteins in which certain amino acids were missing, however, the animals did not grow at all. Thus, with one of the proteins of maize known as zein, the curve of growth actually descended, showing that the animals must soon have died of starvation. Chemical analysis shows that two essential amino acids are wanting in zein, namely, lysin and tryptophan. By adding pure tryptophan along with the zein, a distinct improvement was noted in the curve; it no longer descended, but remained practically horizontal, indicating that now, although incapable of growing, the animals were being at least maintained. Evidently, then, proteins must contain tryptophan if they are to prevent starvation. If lysin, as well as tryptophan, were given along with the zein, the curve of growth became normal, that is, it became the same as that obtained when perfect proteins such as casein are fed. Lysin, therefore, must be an important amino acid for growth, and it is of great significance that there is a high percentage of lysin in all those proteins that are concerned in nature with the growth of young animals; thus, it is present in large amount in casein, lactalbumin and egg vitellin.

The condition of the animal that has been fed on inadequate proteins is of great interest. When the aromatic amino acid, trytophan, which, as we have seen, is essential even for maintenance, was absent, the animal soon passed into a serious condition of malnutrition. Its fur became ruffled, its eyes inflamed, its feet cold, and it remained in a condition of torpor. By adding tryptophan to the diet, these symptoms immediately disappeared, and the animal became perfectly normal in every respect except that it failed to grow. It remained healthy but stunted. A most interesting question here presents itself, namely, has the power to grow become lost, or has it merely become suppressed by the absence of lysin? It is of great significance that growth merely becomes suppressed, for when the stunted animal was given a perfect protein, such as casein, it immediately began to grow with great rapidity, and soon attained the size of its now full-grown brothers and sisters.

Although it is particularly the vegetable proteins that are likely to be deficient in essential building stones, certain animal proteins, such as gelatin, are also lacking. Gelatin, like zein, contains no tryptophan, and like zein, it can not, therefore, maintain life. It is not a true protein but it is a valuable adjunct to protein food, because it contains many useful amino acids.

It should be emphasized that in wheat and maize besides the imperfect proteins, gliadin and zein, there is also another protein that is of first quality, namely, glutenin. This is present in sufficient amount to make even strictly vegetarian diets perfectly safe, provided enough of either of these cereals is taken to allow for the fact that only a part of the protein is of first quality.

Now it will be asked, how are we to make certain that suitable variety of protein building stones is present in the diet? The answer is that there is little chance of inadequacy in this regard provided several varieties of protein food are given. "Provide sufficient calories and let the proteins take care of themselves," is a perfectly safe rule to work by, provided animal proteins are used. Real danger from protein starvation could arise only in the case of strict vegetarians who did not take a sufficiency of wheat or corn, for, although other vegetable proteins than glutenin do contain all of the essential amino

acids, yet they may be deficient in this regard, and it would be decidedly risky to attempt to live on them alone. Strict vegetarians are, therefore, liable to run the risk of partial starvation. One of the most valuable of proteins is probably casein of milk; another vitellin of egg yolk. A glass or two of milk with an egg, along with vegetable food, makes the diet a safe one, provided always, of course, that the caloric requirements are met, and that no excessive wear and tear of the tissues is going on.

But it is probable that such a diet is inferior to one containing a proper, but not excessive, amount of animal proteins. It has been found that the smallest amount of protein required to maintain nutritional equilibrium is secured by taking flesh food, along with abundance of carbohydrate and fat, because obviously this, in its amino acid make-up, comes closest to that of the animal's tissues.

These considerations lead to the question: To what extent may the proportion of protein in the diet be reduced with safety? It is evident that there must be a minimum below which every one of the necessary building materials of protein would not be supplied in adequate amount to reconstruct the worn-out tissue protein.

The extent to which the protein content of the diet of man can be lowered with safety depends on several factors, of which the most important are: first, the nature of the protein; secondly, the number of nonprotein calories; and thirdly, the extent of tissue activity. Where so many factors must be taken into consideration, the only method by which the actual minimum can be determined consists in what may be called "cut and try" experiments. Of the many investigations of such a nature, probably the best one is that recently published from the Nutrition Laboratory of Copenhagen. The subject, an intelligent laboratory servant, lived a perfectly normal and active life for a period of five months on a diet of potatoes cooked with margarine and a little onion, and containing 4000 C., with a total protein content of 29 grams. During another period he did outdoor work as a mason and laborer, and took 5000 C. daily, and 35 grams protein. Many other experiments of a similar nature make it certain that man can lead a normal existence and remain in good health on very much less protein than the 100 grams which statistical studies show to be the amount which he actually takes. This discrepancy between the amount which experiment demonstrates to be adequate and that which habit and custom demand, raises the question as to whether, after all, our instincts may not have erred and so made us unnecessarily extravagant in our protein intake. It has been suggested that such protein extravagances, will in various ways, have a deleterious effect on the organism; thus, that the excretory organs, such as the kidneys, will be overtaxed in eliminating the unused amino acids, that the constant presence of the bodies in excess in the blood will cause degeneration and sluggish metabolism, and that the excess protein in the intestine will lead to the production of ptomaines, whose subsequent absorption into the blood will cause toxemic symptoms.

Important support to such views appeared to be supplied some dozen years ago by Chittenden, who was able to show that he himself and many other persons doing different kinds of work could be supported on daily amounts of

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The extent to which the protein content of the diet of man can be lowered with safety depends on several factors, of which the most important are: first, the nature of the protein; secondly, the number of nonprotein calories; and thirdly, the extent of tissue activity. Where so many factors must be taken into consideration, the only method by which the actual minimum can be determined consists in what may be called "cut and try" experiments. Of the many investigations of such a nature, probably the best one is that recently published from the Nutrition Laboratory of Copenhagen. The subject, an intelligent laboratory servant, lived a perfectly normal and active life for a period of five months on a diet of potatoes cooked with margarine and a little onion, and containing 4000 C., with a total protein content of 29 grams. During another period he did outdoor work as a mason and laborer, and took 5000 C. daily, and 35 grams protein. Many other experiments of a similar nature make it certain that man can lead a normal existence and remain in good health on very much less protein than the 100 grams which statistical studies show to be the amount which he actually takes. This discrepancy between the amount which experiment demonstrates to be adequate and that which habit and custom demand, raises the question as to whether, after all, our instincts may not have erred and so made us unnecessarily extravagant in our protein intake. It has been suggested that such protein extravagances, will in various ways, have a deleterious effect on the organism; thus, that the excretory organs, such as the kidneys, will be overtaxed in eliminating the unused amino acids, that the constant presence of the bodies in excess in the blood will cause degeneration and sluggish metabolism, and that the excess protein in the intestine will lead to the production of ptomaines, whose subsequent absorption into the blood will cause toxemic symptoms.

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protein that were not more than from one-third to one-half of the amount usually taken. Not only so, but it was averred that distinct improvement was experienced in the general sense of well-being and of mental efficiency as a result of the lesser protein consumption.

Taking these results as a whole, it is quite clear that man can get along under ordinary conditions with much less protein than he ordinarily takes. This really proves nothing, for the question is not *can* he, but *should* he so deprive himself. Are instincts and customs wrong, and is Chittenden right?. That is the question. To answer it many studies have been made of the condition of peoples who for economic or other reasons are compelled to live on less protein than the average. Are these people healthier, less prone to infections and degenerative diseases, and more efficient mentally than others? In such studies great care must be exercised to see that conditions other than diet, such as climate, exercise, etc., are properly controlled. It would not, for example, be fair to compare the mental and bodily condition of peoples living in the tropics and who take comparatively little protein, with those living in temperate zones, who consume much more. After discounting all of these other factors, it has been quite clearly shown that, when the protein allowance is *materially reduced,* the people as a whole are less robust, mentally inferior and, instead of being less prone to the very diseases which are usually supposed to be due to overloading of the organism with useless excretory products, they are more liable to suffer from them. That a considerable reduction in protein weakens the defense of the organism against infection is probably due to the fact that the fluids of the body normally contain a great variety of so-called antibodies, that is, of highly complex substances that are largely protein in nature. When bacteria, or the poisons produced by them, enter the body, they are met by one or more of these defense substances and destroyed or neutralized. Now it is clear that there should always be a surplus of protein building materials from which these antibodies may be constructed. Such an excess will constitute a "factor of safety" against disease. And there are factors of safety of another nature to be produced, two of which we are in a position to appreciate. In the first place, there must always be an adequate supply of tryptophan, of lysin, and of cystin, not only to meet the bare necessities of the protein constructive processes that go on under normal conditions, but also to make good the larger amount of protein wear and tear that greater degrees of tissue activity will entail. Although moderate muscular exercise does not appear to cause any immediate consumption of protein (carbohydrate and, later, fat being the fuel material used to produce it), yet it does throw a greater strain on the tissues, a greater wear and tear of the machinery, and hence a demand for more protein building material. In the second place, there are certain of the internal secretions of the body, such as epinephrin (adrenalin), which are essential for life, and as crude materials for the manufacture of which certain amino acids are essential. Tyrosin is one of these, and since, as we have seen, proteins differ from one another quite considerably in the amount of this amino acid which they contain, it is advisable to provide an excess so that an adequate supply of tyrosin may always be available.

The answer to one of the most important practical questions in dietetics, namely, "What proportion of protein should the diet contain?" depends on these scientific principles. The source of the protein is the important thing. With animal protein there is no doubt that we could get along with perfect safety by taking daily not more than 50 to 60 grams, which is about half of what we actually take. If the protein be of vegetable origin and of the first quality, such as is contained in wheat and maize preparations, more should be taken, because of the fact that the protein in these cereals is only half of the first quality. When vegetable proteins of the second quality, such as those of peas, beans, lentils, etc., are alone available, much larger amounts are necessary. Such proteins are inadequate in the case of growing children at least, and even in adults it is undoubtedly advisable that other proteins should supplement them.

To insure safety, therefore, it is almost imperative that the diet should contain *proteins of various sources.* If for economic reasons the main source must be proteins of vegetable origin, then some animal protein, such as is contained in milk or meat or eggs, should be added to at least one of the daily meals. Thus, when peas and beans are mainly depended on for the protein supply, they should be taken either with milk or one of its preparations, or with a thick gravy or sauce made from meat and containing the finely minced meat. This must not be strained off, for if it is, the sauce will contain only the meat extractives but not any of the protein, for these are coagulated by the boiling water. Meat extract, in other words, contains no proteins; it is not a food but merely a condiment of no greater dietetic value than tea or coffee.

The question has been asked, "What should we take in place of meat if one or two meatless days have to be introduced in order to conserve the food supply?" The answer is that milk and eggs will completely make good the deficiency, or if these also be unavailable, then the taking of a more liberal supply of wheat or maize preparations will be satisfactory. Protein deficiency for one or two days a week could, however, scarcely entail any risk to health provided the usual allowance of animal protein or of first quality vegetable protein be allowed on the other days. The value of potato protein should be remembered in this connection. In any case the attempt should always be made to give a variety of proteins. That the animal economy prefers, if it does not demand, such a mixture even if the best varieties of protein is indicated by the fact that milk, the perfect food for early growth and development, contains two such proteins—casein and albumin.

Regarding the relative quantities of fats and carbohydrates, the usually accepted figures are: fat, 80 grams (3 oz.); carbohydrates, 400 grams (14 oz.); that is, a ratio of 1 to 5.

Even when the calories and the protein are correct, the diet may be inefficient because of absence of minute quantities of peculiar substances of unknown composition. These have been called vitamines, but this is a most unfortunate name, since an amine is a well characterized chemical substance, whereas these "accessory food factors," as they are better called, are not.

Failure of nutrition due to the absence of accessory food factors is really no recent discovery. It was known to sailors in the bygone days of sailing vessels that despite a liberal allowance of well-mixed preserved food, a long voyage was almost certain to lead to the development of ill health, despondency, and incapacity for work, or perhaps of the disease, scurvy, itself. The discovery was, however, made by the famous Captian Cook that this unhealthy condition of his sailors could be relieved by compelling them whenever possible to go ashore and eat of the fresh foods, either animal or vegetable, that might be available. It was perfectly clear that such foods contained something of great benefit to health that was lacking in the ship's galley. The giving of orange or lemon juice in certain cases of malnutrition in children has also been known for some time in medical practice, but the impetus to a more searching investigation of the nature of these unknown accessory food factors was given by the discovery that the curious disease called beriberi, often observed in certain tropical countries, was associated with the taking of polished rice in place of the less popular grain still having some of the husk attached. This observation led to a systematic investigation of the association between this and the analogous disease which develops in pigeons when these birds are fed exclusively on polished rice. It is found that the addition to the polished rice of an alcoholic extract of the husks very promptly removed the symptoms, and that other things like yeast had a similar effect. Several investigators attempted to isolate this vitamine, as they called it, in pure condition, and thus determine its exact chemical composition, but with little success. Among the most careful of these investigations are those of McCollum, who has come to the conclusion that there are at least two accessory factors concerned, one of them soluble in fat and present in adequate amount in butter and other animal fats, but not in vegetable oils, and the other soluble in water and present in wheat, vegetables, fruits, etc. Milk contains both of these factors, so that its inclusion in a diet is a safeguard, not only against inadequacy in suitable protein, but also against the absence of accessory food factors. There is little danger of the diet being inadequate with regard to food factors if it contain some fruits or green vegetables or unheated fresh milk. The food factors are destroyed by prolonged cooking.

Digestibility and Palatability.—No matter how perfect in calories, protein, and accessory food factors a diet may be, it will fall short of being really adequate if it is not properly assimilated. It is the function of the digestive apparatus to break up the highly complex molecules of protein, fat, and carbohydrate sufficiently to permit them to pass through the lining membrane of the intestine into the blood and lymph. This disintegration is effected by the digestive ferments which are contained in the digestive juices. Of these, saliva, the gastric juice, and the pancreatic juice are best known. In the cases of protein and carbohydrate, the activities of the ferments are interdependent, in the sense that the foodstuff must be acted on by the ferments in a definite order. One ferment prepares the foodstuff for the action of the next. Without this preliminary treatment the second ferment can not properly unfold its action. The conditions are like those existing in a factory where the products

of one department are further worked up in another, which then hands on its product to a third and so on.

These facts indicate that for efficient digestion it is essential that the *initial* digestive juice be secreted in proper amount and at the proper time. The first digestive ferment which acts on protein is the pepsin of gastric juice. A fundamental question in dietetics is: On what does the secretion of this juice depend? The answer is: On the gratification of appetite. No one, judging from his own experience, will probably deny the correctness of this answer, for we all know that unappetizing food is likely to be followed by a sense of gastric discomfort, if not by symptoms of indigestion. Are there, however, any scientific observations from which the true value of this factor in the initiation of the digestive process can be appraised? Thanks to the brilliant work of the great Russian physiologist, Pavlov, we have such information. Pavlov's experiments were made on dogs, but the results have been shown, particularly by Carlson, to be very similar in the case of man. The observations were made on animals in which an artificial opening or fistula had been made into the stomach. Through this fistula the secretion of gastric juice could be observed, and it was found that very shortly after taking some savory food by the mouth, a copious secretion of gastric juice was set up, and that this occurred even although the food after being swallowed was prevented from entering the stomach, by making a fistula in the esophagus. The experiment is called "sham feeding." Not only this, but a hungry animal would secrete the gastric juice even although the food was not actually placed in the mouth but merely offered to it. The anticipation of an appetizing meal, as well as the gratification of receiving it, can set up the flow. It is called the psychic or *appetite* juice. If the animal were not hungry or had no appetite for the particular food, no juice was observed to flow.

The pepsin in this psychic juice sets the ball of protein digestion rolling. Once started, this process goes on automatically, because the digestive products produced by the appetite juice have the power of directly stimulating the gastric glands to further activity, and when the food has been digested to a somewhat further stage, the stomach delivers its contents, in small quantities at a time, into the beginning of the intestine, where by again acting directly on the lining membrane it excites the flow of pancreatic juice, a ferment of which, namely, *trypsin,* carries the digestion to still another stage, until finally the protein molecule is sufficiently broken up to be attacked by the ferment *erepsin* present in the intestinal juice and intestinal mucosa. The whole process, therefore, depends for its proper accomplishment on the appetite juice. It is like a fire: the psychic juice is the kindling material; when it is ignited, the combustion goes on automatically, one stage leading to the next. Some substances, such as the so-called extractives of meat, act like partially digested protein in directly stimulating the secretion of gastric juice.

We have seen that practical dietetics depends on several factors, the exact relative importance of which can not perhaps in every case be gauged, but preparation of the food so as to make it appetizing, must undoubtedly rank high. The importance of *good cooking* will now be apparent. It is the act of making

food appetizing and, therefore, digestible. It is really the first stage in digestion, the stage that we can control and one therefore to which much attention must be given, especially when it becomes necessary to make attractive articles of diet ordinarily considered common and cheap. Most people can cook a beefsteak or a lamb chop so as to make it reasonably appetizing, but few can take the cheaper cuts of meat and convert them into cooked dishes that are as popular and attractive. There are still fewer who can take the left-overs and trimmings and convert them in the same way. This is the real art of cooking, and too much encouragement can not be given to the effort which our cooking experts are making to show people how these things can be done. The waste of good food in a large city is appalling. An army could live off our garbage cans. I need not dwell on this most important phase of the food conservation problem. I would only add that every housewife who desires to do her "bit" in the present emergency can do so in no way better than by learning to use *all* the odds and ends of the kitchen in such a way that they can be offered as appetizing food to her household. It is worse than useless to dish things up unattractively, for under such circumstances food becomes poison.

Cooking has other advantages than making the food appetizing. The heat loosens the muscle fibers of the meat so that it is more readily masticated; it destroys microorganisms and parasites in the meat; it destroys antibodies which might interfere with the action of the digestive ferments. Thus, raw white of egg is not digested in the stomach because it contains one of the antibodies which prevent the pepsin from acting on it. Boiled egg white, if properly chewed, is digested, and whipping the egg white into foam partly destroys the inhibiting substance.

Before concluding, something should be said about the *laxative qualities of food,* for it is often in this particular alone that one food is more satisfactory than another. A diet of meat, milk, eggs, and white bread is apt to be unphysiologic because there is nothing in it to serve as what has been called intestinal ballast, that is, a material which will keep the intestines sufficiently filled to stimulate their muscular movements. This ballast is best furnished in the shape of cellulose, the most important constituent of green food. Peas, beans, cabbage, salad, and many fruits, especially apples, should always occupy a place in the daily menu. Another valuable food yielding this ballast is the outer grain of wheat, oats, etc. So much must not be taken as to produce a constant intestinal irritation, and each person must determine for himself where this limit lies. The difference between various breads is almost entirely in the degree to which they supply ballast.

APPENDIX.

It will be remarked that nothing is said in the foregoing article concerning the methods by which a given diet can be composed so as to supply the required number of calories. This is a detail which could be adequately discussed only by reference to extensive diet tables, the publication of which is unnecessary here. It may help if we give some rough and ready rules by which such tables may be satisfactorily used. As a type of diet table take the following:

FOOD	PROTEIN PER CENT	FAT PER CENT	CARBOHYDRATE PER CENT	CALORIES PER LB.
Average of beef, veal, and mutton	14.5	16.1	...	913
Pork	12	29.8	...	1477
Bacon	9.5	59.4	...	2685
Fish (general average)	10.9	2.4	...	295
Eggs (2 oz. in shell)	11.9	9.3	...	613
Milk (whole)	3.3	4	5	322
Cream (average)	2.5	18.5	4.5	908
Butter	10.	8.3	...	3510
Cheese	25.2	33.7	2.4	1950
Bread (average)	9.2	1.3	53.1	1215
Rice	7.4	0.4	79.2	1620
Legumes (dried average)	2.4	1.7-2.3	54	1500
Potatoes	1.8	0.1	14.7	310
Green vegetables	1.4	0.2	4.8	145
Fruit (average)	0.4	0.5	8.	180

(McKillop)

Having decided how many calories a day is required according to the principles laid down on page 747, proceed to weigh out each of the articles of food that it has been customary for the person or persons to take. If the calories do not correspond to the required number, add or subtract a proper amount of one or more foodstuffs, using the figures in the fourth column of the table for this purpose. Having adjusted the food allowance according to calories, proceed to see whether there is sufficient protein according to column 1 and the principles explained on page 756. The simplest way to do this is, first, to multiply the number of ounces of each foodstuff used by 28.4 (grams to an ounce), and then by the percentage figure given in the first column. The product divided by 100 gives the grams of protein. Finally calculate by the same method the grams of carbohydrate and fat, and see that they bear the ratio to each other of about 4 to 1.

Finally, it should be remembered that the above requirements refer to foodstuffs actually digested. In the case of protein, 10 per cent is usually subtracted from the crude protein in arriving at this figure. For fats and carbohydrates the figure is quite variable. The figures in the above table are also for raw materials. Where there is evident loss in cooking, proper allowance must, of course, be made.

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EDITORIALS

The Commercialization of Scientific Essays

IN a recent editorial we dealt with the commercialization of scientific societies, and we also had something to say in regard to commercialization of scientific essays in an editorial dealing with the object of orthodontic societies, as a result of which we have been questioned more in detail as to what we were referring to by the commercialization of dental and orthodontic societies. To be more specific, we will call attention to one particular phase of the subject in this editorial which deals with the commercialization of scientific essays and we will cite some instances in regard to conditions at the present time that look very bad for independent societies composed of thinking men such as are members of orthodontic societies.

A very good example of the commercialization of a scientific essay occurred in a very prominent dental journal last summer. There appeared in the first

pages of the dental journal an article describing a new style of appliance which had recently been patented. It was claimed that this appliance possessed wonderful virtues and advantages over anything that had ever been used, and the appliance was supposed to be described from a purely scientific and unbiased standpoint. The description of the appliance was written by the inventor. This condition was bad enough, but as the paper was not presented before a large independent society of orthodontists, that phase of the question can, to a certain extent, be overlooked. However, due to the fact that the article was published in a dental journal, which is published by a trade house and is supposed to represent the highest type of dental journal which the profession has at the present time, it was given great publicity, being published in the front pages. Some of the illustrations in the article showed the trade-mark of the trade house, and showed certain patented appliances which could only be obtained from the manufacturers, who were also the publishers of the trade journal. This does not look well from the purely scientific and independent standpoint. Another feature that would suggest that this essay had been commercialized, was the fact that in the advertising pages of the same issue of the dental journal there appeared an announcement that the manufacture of the appliance was under way and prices would be announced in the October issue of the journal by the manufacturers, who were also the publishers of the dental journal. In the advertisement, which was set in large bold type covering the entire page, the reader was referred back to the article on pages 969 and 994 of the journal. In other words, the essay that was supposed to be a scientific essay was nothing more than a smooth advertisement for the sale of the appliance.

While the author may not have written the paper with a view of selling the appliance, the publishers of the dental journal, who were also the manufacturers of the appliance and who paid the author a royalty for the use and control of the patent, were commercializing the paper by advertising it in the back part of the journal. In other words, the scientific (?) pages of the journal, which is supposed to be the most respectable dental journal in the United States, were made nothing but a clean, smooth, advertising sheet. This is a typical case of the commercialization of a scientific essay, and an insult to an independent, free thinking body of men such as orthodontists.

To make matters still worse, the manufacturing concern that is publishing the journal had reprints of the paper made and sent them broadcast, accompanied by a price list of the regulating appliance,—still the essay was called a scientific paper. It was still said to have been written in the interest of science; but it looks very much as if it were written in the interests of the publishers of the dental journal and the manufacturers of the regulating appliance.

A similar case of the commercialization of scientific articles, and one which looks bad from a purely scientific standpoint, is a series of articles which are being published in another trade journal, describing certain methods which are being advocated by the writer of the articles. The essays have been running through a number of the issues of the journal, and contain considerable information that is more or less of scientific value. The articles are very well written. However, there is in all of them inference to a certain method, which method is described in such a manner as to enable no one to use it. We believe

this scientific article loses a certain amount of its scientific value due to the fact that the scientific part appears in the advertising section of the journal. The advertisement describes a plan, or method, whereby the reader can avail himself of a certain amount of information which is described in the scientific article by consulting the essayist. In other words, a scientific article is published in the scientific pages of the trade dental journal, signed by the writer; while the advertising section contains a two page featured advertisement, signed by the same man, giving the same address that is given in the scientific article. We again contend that this is commercialization of what should be a scientific essay; and a scientific essay, to a certain extent, loses its dignity when confused and mixed up with the commercial advertisements.

Another example of the commercialization of scientific essays is found in the case of a paper, read before one of the oldest societies of orthodontists, describing a certain style of appliance. Later we were informed that the man reading the paper was interested in a patent that had a bearing upon the appliance he described. The essay was further commercialized by a demonstration of a certain style of commercial appliance which is sold by dental supply houses, and which is manufactured by a friend of the essayist. The appliance was illustrated for commercial reasons. The essayist did not illustrate that particular style of appliance because he thought it was the most advantageous, for we are told that the essayist later admitted, several months afterwards, that he had not used that particular style of appliance for several years before the paper was written. In other words, he allowed a scientific essay to be commercialized to the extent of exhibiting a style of commercial appliance which he did not use in his own practice because the paper might assist in selling the appliance. We contend that this is another example of the commercialization of a scientific essay, which only had a detrimental effect upon orthodontia, and which made the science of orthodontia appear ridiculous as compared to other sciences.

It is, therefore, time for orthodontia, as a science, and for orthodontists, as individuals, to pause and consider whether they are going to continue to allow themselves and their societies to be used as a furtherance of some particular patented regulating appliance, whether they are going to allow their literature to be dominated by dental supply houses that will allow anything to be published so long as it exists in the advertising section of the journal, or whether they are going to make a stand for clearer and freer journalism. Undoubtedly, orthodontists do not realize the seriousness of this condition.

Dental Hygienists

CERTAIN men in the dental profession have advocated for some time that there be some provision made in state laws that will enable dental assistants, or persons not regular licensed dentists, to perform certain dental operations in the mouth which are supposed to be confined to cleaning and scaling of teeth. It has also been advocated that there be some provision made for dental nurses, who should have a standing somewhat superior or above that of an assistant who has not had a definite course of training. As a result of this con-

tinuous cry from some men in the dental profession, certain state laws have been modified recently to enable dental assistants who have taken a certain prescribed course of study to perform certain operations upon the teeth.

Anyone who is familiar with the work done by the medical nurse will agree that the medical nurse has a position and a standing in the medical profession, and that she renders a great service. However, we do not believe that the dental nurse, the "dental hygienist," being advocated by some of the enthusiastic supporters, has the right to distinction or standing that the medical nurse has, for reasons which we will state later.

We shall also believe, as the editor of the *British Journal of Dental Science*, that the term "dental hygienist" is an unfortunate word. We of the profession have not been willing to permit a person who has received a short course of training to be called a dentist, yet provision has been made in some places to call them a "dental hygienist." This gives them some sort of a high sounding title which, to a certain extent, will confuse the public and make the public believe that the dental hygienist is something which she is not. We do not believe that anyone who has taken a prescribed course of study as outlined in so-called schools of dental hygienists or dental assistants is entitled to use the word "hygienist," because one versed in hygiene is certainly one that is versed in more than the scaling and cleaning of teeth. The word "hygienist" is applied to medical officers of health, men who have devoted years of training and study in medicine, and who have taken special courses in regard to sanitation. They have spent at least six years in the study of their profession and are entitled to be sanitary officers or hygienists, and now some of the dental profession come along and put the stamp of approval on the "dental hygienist" who has only a course of training of a few weeks.

We believe that the cleaning and polishing of teeth and treating diseased conditions of the gum is entirely too important a phase of dentistry to be turned over to an assistant who has only had a few weeks course, or to anyone who has not had a complete course of training in a dental college. In fact, we can say that the average line of training that is given in the dental college is not sufficient to enable the average dentist to properly treat, clean, and scale teeth. The work which is supposed to be delegated to the dental hygienist is entirely of too much importance to be left to one who has less knowledge than that possessed by the average dentist. We have previously stated that we do not believe the dental nurse as being advocated at the present time is qualified to take a position along with the medical nurse, in fact, we believe it is an insult to the medical nurse to attempt to give the dental nurse any such standing or rating when we consider the courses the two are obliged to follow.

The medical nurse, besides being compelled to have a high degree of preliminary education, is compelled to spend three years of constant service and study in a hospital, which are three of the most strenuous years that anyone ever puts in. Anyone who is familiar with the course of study that a nurse pursues in a modern hospital realizes that she has taken a course which very few dentists would be anxious to go through. The course which the dental nurses are supposed to take or the "dental hygienists" is very much inferior

and in fact may be considered a joke in comparison with the course which the medical nurse takes.

In this number of the Journal we review a book called "Mouth Hygiene," which contains a course of instruction for "dental hygienists." Out of this *single book* dental hygienists are supposed to receive all the necessary instructions to enable them to carry on their work. The fact that they are able to carry on their studies from the perusal of a single book again shows that the dental nurses have no standing or rating as compared with medical nurses. In further comparing the unsatisfactory and insufficient course that the "dental hygienist" receives, we will quote from the preface which may be considered as a standard of the course which dental hygienists are to receive. It says:

"These questions have repeatedly been asked: 'Where are we going to secure such women, educated and trained as dental hygienists? Where are they to secure such an education? What should constitute a course of lectures and practical training? Are there textbooks that they may study to comprehend and perfect themselves in this dental work?' "

You notice the word *perfect* is used, which is something that very few of us ever succeed in doing in our profession. The preface further states that the main object of this publication is to give a definite answer to these questions and introduce an educational course for the "dental hygienist" which will prove to be something definite and concise.

"In the fall of 1913 gentlemen whose names appear as contributors to this work were approached and asked if they would aid in such a cause, if they would come to Bridgeport and deliver their lectures to a class of thirty-two women, the lectures to be taken in shorthand, sent to them for correction and condensation so that the pith of the subject might be published in a textbook for the education of women assistants in prophylaxis."

You will notice that the education of women assistants in prophylaxis is to be obtained from a single textbook. We mention this not as defect in regard to the textbook, but as a defect in the system, thereby showing what insufficient education the dental hygienists are going to have and the great danger that is being forced upon the dental profession by some enthusiastic men who are in favor of dental nurses.

The preface further states that the course was given, that "the lectures were held in the evening on Mondays, Wednesdays, and Fridays, and with the exception of vacation at Christmas time, ran from November 17 until March 30," a period of slightly over four months in which these "dental hygienists" received lectures in the evening three days a week. "The class assembled at 7:30 P.M. and a review of previous lectures was taken up by one of the quiz masters. At 8 P.M. the lecturer of the evening commenced, and lectured until 9:30 P.M. or thereabouts."

It certainly seems to us that this is an insufficient course to give an individual to entitle her to be called a "dental hygienist" or a "dental nurse," and expect the public to give her any such a standing or recognition as is given the medical nurse. We are not opposed to dental nurses, but we do believe that a dental nurse, in order to have any standing and not be considered a joke in the dental profession, must have a course of training as scientific and complete as

that of the medical nurse. We do not believe that a dental nurse can be taught in four and a half months by receiving lectures three evenings a week which extend say from 7:30 to 9:30 P.M.

In further substantiation of the incomplete manner in which uneducated girls who are going to be forced upon the profession as "dental hygienists," we call attention to an announcement that is being sent out by the Forsyth Dental Infirmary for Children which states that, beginning October 17, the Forsyth Dental Infirmary for Children, Boston, Massachusetts, will conduct a training school for dental hygienists. The circular or announcement states that the candidate must be eighteen years of age and must present a certificate of graduation from an approved high school or an equivalent of four years of high school study. The course of study covers a period of twelve months, the clinical hours being from 9 A.M. to 5 P.M. The courses of lectures and demonstrations given outside of these hours embodies the following subjects: orthodontia, histology, anatomy, physiology, bacteriology, oral bacteriology, laryngology, roentgenology, investing tissues of the teeth, contagious, infectious, and communicable diseases, general and oral hygiene, instrument and technic work, operative technic, clinical dentistry, clinical prophylaxis, oral pathology, sterilization and asepsis, dental pathology, teaching oral hygiene to children, oral surgery, extraction, novocaine anesthesia, dental jurisprudence, therapeutics, prosthetic prophylaxis, dental materia medica, general organic chemistry, orthopedics and neurology. Truly a wonderful array of subjects, and if anyone can inform us how a living individual in twelve months can master the subjects outlined there, working from 9 till 5, we are willing to admit they are superhuman. A twelve months course for dental nurses is better than a course of four and a half months, but we recognize the impossibility of teaching in twelve months even a rudimentary knowledge of all the subjects outlined in the announcement sent out by the Forsyth Dental Infirmary for Children.

We realize it is going to be a valuable thing for the Forsyth Dental Infirmary for Children if they can impress upon a number of girls who have the preliminary education which they require to spend 12 months in the supposition that they can learn everything in regard to the subjects mentioned in the announcement; but we ask whether it is fair to the students.

The subjects outlined in the announcement of the Forsyth Dental Infirmary for Children and the training school of dental hygienists are enough subjects and are practically the same subjects as are covered in a dental college. We have the same criticism to offer of this course that we made of the work on "mouth hygiene." It is absolutely impossible in a course of twelve months to give even a preliminary understanding of the subjects outlined in this announcement, even if the subjects are published to give a wonderful array of the ground covered and produce a wonderful effect on prospective students, and then insufficiently taught. Anyone who has had any experience in dental college work knows that the subjects of histology, anatomy and physiology can not even be approached in one year. Then of all the various other subjects outlined it shows that the course for "dental hygienists" is going to be very superficial and consequently of very little value. The clinical hours which are spent in the Forsyth Dental Infirmary from 9 A.M. to 5 P.M. will be more or less valuable training to

the "hygienist." When we consider the course of lectures and demonstrations to be given outside of these hours, embodying the above mentioned subjects, we can only say that the course for "dental hygienists" or dental nurses requires a whole lot of construction and thought before it will be of much value.

That these subjects are going to be thoroughly taught is proved by the announcement which says that the facilities of the various clinical laboratories in the Infirmary are made available and all of the pupils will receive thorough and comprehensive training to fit them to be teachers in public schools and institutions, and operative dental hygienists in the prophylactic treatment of teeth, and dental nurses in private offices and institutions. They will become thoroughly familiar with the theory of dental practice, sterilization, and administration of anesthetics, and prepare patients before, during, and after administration, also in operative procedures from a surgical standpoint. If the Forsyth Dental Infirmary completes all these things in a *thorough* and *comprehensive* manner in a period of twelve months, there is absolutely no use of a dental college spending four years in teaching a dental student. If the Forsyth Dental Infirmary can teach hygienists all of this knowledge in twelve months, dental colleges may just as well close their doors and admit they are absolute failures when it takes them four years to teach their students the same subjects.

However, this difference between twelve months and four years may be one of personal equation in that women are able to learn dentistry in twelve months while it takes the dental student four years to learn the same subjects. We are willing to admit there is a place for dental nurses, that there should be some place where they should receive proper instruction and the dental profession has a need for them. We are not wililng to admit that they should be given the high sounding name "dental hygienist" and be turned out as being thoroughly competent as a "prophylactic operator." We believe a successful prophylactic operator should have all the knowledge a dentist possesses and some more besides. We believe that a successful prophylactic operator should have a thorough course of education in a dental college and we do not believe that he can receive that course of instruction in four and a half months, nor do we believe he can receive it in twelve months, whether the course is given in Bridgeport or Boston. However, we do believe that a prophylactic operator can attain a certain amount of proficiency if he has taken a complete course of instruction in a dental college and then spends four and a half months or twelve months in acquiring a further knowledge upon that particular subject.

We believe that a dental student who has graduated from a dental college can acquire a knowledge of anesthesia and the use of novocaine, or oral surgery by taking a course of six or eight weeks after he has taken a dental course. We also believe that a working knowledge of roentgenology or radiography can be obtained by a dental student after he has spent three or four years in dental college and then devotes three or four weeks to that particular subject; but we do not believe that a girl or anyone with an approved high school education can spend a year and master the subjects as outlined for dental hygienists by these various schools in any manner that is going to be satisfactory whatsoever. If we are going to have dental nurses we should have a course of instruction which will make dental nurses out of them and not try to make dentists out of them.

Furthermore, let the dental nurse have a course which will be sufficiently thorough and complete along the lines which a nurse is supposed to follow so that she will have a standing equal to the medical nurse and not try to make her something else by calling her a "dental hygienist" or a prophylactic operator because we have too much respect for prophylactic operators and too much respect for prophylactic treatment of teeth to believe it is possible for any institution to make a satisfactory prophylactic operator out of one who has no knowledge of dentistry in four and a half months or even twelve months.

Being familiar with postgraduate work and college work, we caution the dental profession not to let their enthusiasm run wild, along with the warning issued by the *British Journal of Dental Science* that we want to be careful in safeguarding the profession against the encouragement of an irregular practitioner donated with a high sounding title. It seems very illogical to us while attempts are being made to raise the standard of the dental profession and the course in the dental college has been lengthened from three to four years, that institutions and schools for dental hygienists should continue to announce that a thorough and comprehensive training can be given in all the subjects which are cited in this editorial in the course of twelve months. As a result of this we are forced to pause and wonder whether the legalizing of dental nurses under the present plan has been a step forward or a step backward in the proficiency and standard of the dental profession.

The Section on Stomatology of the American Medical Association

IN the *Journal of the American Medical Association,* June 16, 1917, which contains the minutes of the meeting of the American Medical Association held in New York City we notice several facts which are of interest to the dental profession, whether they are members of the Section on Stomatology or not. We do not exactly know how long the Section on Stomatology has been a definite part of the American Medical Association, but we believe the importance of that section has not been appreciated by the dental profession to the extent that it should be.

The registration at the New York session showed the Section on Stomatology with the smallest attendance except one. Forty-seven were enrolled as attending the Section on Stomatology. Considering the nature and interest of the program which was arranged by that section, and considering the center of population in which the meeting was held, we are forced to state that the membership of the Section on Stomatology was not what it should have been. However, it is probable that the Section has tried to obtain quality rather than quantity. In this respect the Section is to be congratulated, because so far as we know, it is the only dental society, or society pertaining to dentistry, in which the membership is to any extent limited. The limitation of membership is the result of a resolution introduced by Dr. William C. Fisher, of New York, which was carried. The resolution is as follows:

"To the House of Delegates: The following resolutions were passed by the

Section on Stomatology and were recommended to your body for favorable consideration:

"Resolved, That applicants for associate fellowship in the American Medical Association holding the degree of D.D.S., or its equivalent, and members of their local, county, or state dental organizations, before their application is approved by the section, must be considered by the executive committee of the section and must be endorsed by at least two members of this executive committee as having attained to a position in the dental profession, either by virtue of original research work done, or some meritorious service rendered to the profession or public which shall, in the judgment of these members of the executive committee of the section, warrant favorable action on the application."

These resolutions were read by the Secretary of the House of Delegates and the House of Delegates approved the action of the Section on Stomatology. We believe this is a wise plan, and we believe it would be a wise plan if more dental societies limited their membership upon the ability of the men joining the Society as having done original research work or performed some meritorious service to the profession or public. In the majority of societies the applicant for membership does not receive the proper consideration which he should receive and a great many men are becoming members of societies whose membership does not improve the society to any extent. However, we are told in local and state dental societies, and the same is more or less true, that the society is for the benefit of the individual and the individual is not supposed to necessarily be a benefit to the society.

It is perfectly well and proper that a certain number of dental societies should to a certain extent do missionary work and try to improve the dental profession by elevating some of the members of the profession, but we also realize that if we are to elevate the profession, we must have a few societies, so planned that in order to obtain membership in that society the man must show more than extraordinary ability in meritorious work or perform original research. We, therefore, believe that the resolution adopted by the House of Delegates approving the action of the Section on Stomatology is a very good plan, and we hope to see the same plan followed in other societies in the near future.

We have often been impressed with the fact that the medical profession did not have the proper understanding or appreciation of stomatology and we have thought recently that the medical profession was realizing the importance of dentistry; but in reading the minutes of the House of Delegates of the New York session, we are impressed with the fact that the general medical profession, as a whole, do not even yet appreciate the importance of dentistry or stomatology. This is proved by the fact that, in arranging the sessions of the scientific assembly in which each section is grouped according to units allowed, we find the Committee on Rules recommended that the Section on Stomatology be allowed only two units, but one other section being allowed so small a number of units.

The fact that dermatology, ophthalmology, laryngology, otology, and rhinology are allowed six units and stomatology only two, clearly indicates that the importance of stomatology is not yet recognized by the medical profession.

We certainly believe that stomatology has a greater importance in the welfare of the human race than does ophthalmology. We recognize the importance of the eyes, but we also recognize the fact that the eyes are more a question of luxury, as some of the animal kingdom live without eyes, but none without teeth, or their equivalent. However, we are pleased to note that through his efforts as delegate from the Section on Stomatology, he was able to amend by substituting three units for two units in reference to the Section on Stomatology. However, we believe at the present time that stomatology has practically 50 per cent of the importance paid to it by the medical profession that it is entitled to according to the ratings of other sections.

There is no use in making objections unless the dental profession, as a whole, recognize the Section on Stomatology as being associated with the American Medical Association, and by working through that Section we believe the dental profession will be able to obtain an earlier recognition from the medical profession than it will by finding fault and doing nothing. We, therefore, recommend that every dentist who is interested in the advancement of dentistry as a profession and in obtaining recognition from the medical profession which we have talked so much about shall perfect himself so that he will be eligible for membership in the Section on Stomatology; and by concerted effort we may be able to impress upon the medical profession that stomatology is just as important to the human race as ophthalmology, laryngology, otology, and rhinology.

The Internal Anatomy of the Face*

SEVERAL years ago when the first edition of Cryer's "Internal Anatomy of the Face" made its appearance there had never been a book written which contributed so much towards the study of the anatomy of the face as did Dr. Cryer's work. We now have the second edition of this valuable contribution to anatomy which is much larger than the first and which contains many more valuable illustrations. Chapter I is an introduction to the study of the anatomy of the face, and Chapter II deals with general considerations.

Chapter III is devoted to the mandible and contains many valuable suggestions and facts which are very often overlooked. The various shapes of the mandible as found in different cases of the individual are shown,—anatomical facts which must be recognized. However, it must be remembered that the changes which occur in the mandible and have been pointed to as the result of age, are produced more or less by the result of use. If it were possible for a person to maintain all of the natural teeth in normal occlusion, there would be very little change in the shape of the mandible from the time the permanent teeth erupted until the time the individual passed away at an advanced age. The greatest factors in the change of the mandible, which have been attributed to age, are the result of use brought about by changing occlusion.

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*The Internal Anatomy of the Face. By M. H. Cryer, M.D., D.D.S., Professor of Oral Surgery, University of Pennsylvania; Oral Surgeon to the Philadelphia General Hospital. 360 pages, 377 illustrations. Second edition. Published by Lea & Febiger, Philadelphia and New York.

The different shaped mandibles found in different races are also referred to, which is a very important point; also different shapes in the angle and the body of the mandible are important factors. These changes are also very often the result of disease or disuse which is a factor that has often been overlooked. A study of the mandibular articulation is also taken up,—another subject that has not received the attention it deserves. It must also be remembered that the changes, occurring in the temporo-mandibular articulation, are the result of the use and occlusion of the teeth, which fact Dr. Cryer clearly demonstrates by showing a number of temporo-mandibular articulations taken from lower animals.

The work contains a very complete study of the maxilla, with a number of cuts showing the cross sections in the nasal and oral cavity with reference to maxillary sinuses and other sinuses of the face.

Chapter V is a consideration of the mouth, including the teeth, in which there are several good features and also the use of some terms which are more or less questionable. For instance, in speaking of the alveolar process the statement is made that the upper portion of the alveolar border is covered by gum tissue. We think it would be less confusing and more descriptive if the word upper and lower in describing positions on teeth would be dropped and the term apical and gingival be used in their place. It would be more descriptive to say that the gingival portion of the alveolar process is covered by gum tissue and it would be less confusing to the student than the use of the word upper which would be all right in the mandibular teeth, but would not be exactly correct on the maxillary teeth.

In the description of the human teeth we are glad to note that Dr. Cryer has used the more scientific term in describing the teeth under the name of maxillary and mandibular rather than upper and lower. We realize that it will be quite a task to convince the dental profession that the terms maxillary and mandibular teeth are more scientific and descriptive than the terms upper and lower teeth. We are also pleased to note the use of the term canine and premolar in preference to the much overworked term cuspid and bicuspid. In the description of the molars we notice that the term morsal is used where the word occlusal would be more fitting. We believe it is questionable whether a description of the teeth such as is given by Dr. Cryer in the "Internal Anatomy of the Face" should be given. While it is very good and correct, it also lacks very much in detail. In other words, it is a question whether a work on the anatomy of the face should also include a short description of the teeth. We believe that it would be much better if in the future textbooks would be confined to one particular phase of the subject and works on internal anatomy of the face be confined to the internal anatomy of the face and works on dental anatomy be of such a nature as to give a detailed and full description of the teeth themselves, including every phase of the subject as expected to be taught in dental anatomy.

The book, as a whole, is a very valuable contribution to dental literature; the illustrations are above the average, and it is a textbook that should be in the library of every man interested in the science of dentistry.

Mouth Hygiene*

A FEW months ago there came to our office a very beautifully bound and printed book of the above title, containing a number of illustrations. In going over the table of contents it appears that the author of the book has attempted to cover every phase in the field of dentistry, and consequently in order to do this, each subject is more or less partially treated. At first glance it would seem that the authors have the desire to cover the entire dental field, thus necessitating the use of only one textbook. This would be a very great advantage to the average dental student, for we realize that the majority of dental students today are opposed to buying textbooks. If the publishers of this textbook have succeeded in getting all the necessary knowledge under one cover, in so doing they have performed a very great service to the dental student.

However, in studying the preface we find that the book is intended to contain the fundamentals necessary for prophylactic operators, but even with this point in view we very much question the wisdom of attempting to give prophylactic operators an education which covers such a wide field as is outlined in the work on mouth hygiene and the superficial manner in which each subject must necessarily be treated.

The first chapter, written by Raymond C. Osburn, Ph.D., on anatomy, contains 56 pages and covers the entire field of anatomy, including histology, the study of the cells, the nutritive system, the alimentary canal, the respiratory system, the circulatory system, the ductless glands, the skeleton, the muscle and the nervous system. It is our belief that it is absolutely impossible to cover the field of general anatomy in 54 pages in such a manner as to give the prophylactic operator even a hazy idea of the subject. We do not believe it is possible to describe the anatomy of the mouth in that many pages, hence to cover the entire anatomic field is impossible.

The second chapter dealing with special anatomy which is edited by Robert H. W. Strang, M.D., D.D.S., deals with the various parts of the cranium and the skull, the maxillary sinuses, takes up a description of the eyes, of the ears, the maxilla and the mandible, a description of the oral cavity, of the cranial nerves, the intermaxillary arteries, the tonsils, and teeth. He also goes into the histologic structure of the teeth and this chapter, like a former chapter, covers entirely too much ground in a superficial manner. Likewise the question of physiology is taken up in Chapter III and we believe that the chapter as treated, unless read by one who is more or less familiar with the subject of physiology, would simply tend to be confusing because the subject is very much abbreviated and described in such a brief manner. The same may be said to be true of bacteriology and the other subjects which are mentioned. We realize that oral prophylaxis specialists must have a knowledge of these subjects. We are also aware of the fact that a little knowledge is a dangerous thing, and only a little knowledge can be crowded into a book of this nature. The subject of inflammation and dental caries is also treated, and illustrations are taken from standard works by other men. But again, the description is too brief to be of any practical nature.

*Mouth Hygiene. Compiled by Alfred C. Fones, D.D.S., Bridgeport, Conn. 530 pages, 278 illustrations, 7 color plates. Published by Lea & Febiger, Philadelphia and New York, 1916.

We find Chapter VIII dealing with the teeth as a masticating machine. This is a very important chapter. It deals with comparative dental anatomy and contains a very large number of illustrations. But you will now remember that the dental hygienist has thrust upon him a chapter dealing with comparative dental anatomy in a very brief manner. However, that portion of the chapter dealing with the mechanism of mastication is very good and very ably written by Dr. Turner.

Chapter IX deals with odontalgia and alveolar abscess, and is written by R. Ottolengui, M.D., D.D.S., LL.D. Here again we have in one chapter the entire subject of orthodontia, which includes a study of normal occlusion, a definition of occlusion, classification of malocclusion according to the Angle classification, etiology of malocclusion, the growth of jaws, reasons for lack of use, and so forth. In other words, in one short chapter the entire subject of orthodontia is outlined. We believe that the dental hygienist's knowledge of malocclusion should be more than is contained in Chapter IX, because the manner in which the chapter is written, containing only a brief amount of information, is more confusing than of practical value. Likewise the question of pyorrhea alveolaris, written by R. G. Hutchinson, Jr., D.D.S., offers the same criticism that is found in the others. However, in this case the chapter is more brief, containing only 6 pages and each page very limited in treatment.

Chapter XI deals with odontaglia and alveolar abscess, and is written by M. L. Rhein, M.D., D.D.S., D.R.C., U.S.N. According to our understanding, the work of the dental hygienist is not the treatment of alveolar abscesses. Therefore, why this chapter should be included in the book which is supposed to be for the use of dental hygienists is beyond our understanding.

Chapter XII, which takes up dental prophylaxis, written by Albert C. Fones, D.D.S., begins with the study of the cell. We have considerable difficulty in associating the life history of the cell with what we understand as dental prophylaxis. We believe that the cell is too important a subject to serve as an introduction to the chapter on dental prophylaxis. The cell, in order to be studied, should be treated only in a complete manner and not as an introduction to another chapter.

The phase which deals with practical work of oral prophylaxis is very good, and we believe the book would have filled a much greater need had the author confined the book to the subject of mouth hygiene, and not tried to make it an encyclopedia of dentistry, covering the entire dental field. The book even has a chapter on dermatology and syphilis, which are very important medical subjects, also a chapter on the factors in personal hygiene which is of value but our objection to the book as we first stated is the fact that it covers entirely too large a field and consequently each subject is covered more or less briefly and in such a manner as to be confusing to one who has no knowledge of the subject. The entire dental field is too large to be thoroughly covered in one book. Our criticism would be then that the book should have been limited to the title, namely, "Mouth Hygiene," and should not have been made a work on general anatomy, comparative anatomy, histology, bacteriology, pathology, and comparative dental anatomy. In all of our experience we have never seen a book with

so nice a title, nor have we ever found a book in which the authors have made so many attempts to stay away from the subject as is found in this.

This book can be recommended to one who is desirous of getting a smattering of the subject of dentistry by reading only one volume. It reminds us of the day when dentistry had but one textbook which was Harris' "Practice of Dentistry," and one book was considered sufficient for all purposes.

Books on Histology

"TEXT BOOK OF HISTOLOGY," by Rudolph Krause, Professor of Anatomy at the University of Berlin; translated from an original manuscript, printed only in the English language, with thirty-six illustrations. The reference to the illustrations, given in the text, relate to the colored illustrations published in Dr. Krause's "A Course in Normal Histology." The textbook is used in conjunction with "A Course in Normal Histology" which is published in two volumes. The first volume is a guide for "Practical Instructions in Histology and Microscopic Anatomy," translated from the German by Philip J. R. Small, of New York. Published by Rebman Company, New York.

Volume I deals with the technic of the microscope, and the preparation, staining, and cutting of the specimen. The construction of the different parts of the microscope, as explained, will give the student some idea of the work of the instrument. Part one consists of 30 illustrations, covering the subjects above mentioned.

The second volume of the course contains 208 colored pictures, arranged on 98 plates, after the original drawings by the author. It consists of 406 plates of text, which is given over exclusively to the description of the illustrations, to be used in conjunction with the "Text Book of Histology," which describes the organs illustrated entirely from the histologic standpoint, and does not deal so much with the specimen. The illustrations referred to in the "Text Book of Histology" are those appearing in "A Course in Normal Histology." Therefore, it is necessary, in order to get the greatest amount of good out of these works, to have the three volumes, which will give a much better understanding of the subject than can be obtained from any single work on histology with which we are familiar. The work is specially recommended to the practitioners interested in histologic studies, and who desire more information upon the subject than can be obtained in the usual work on histology, which very often has been prepared from the student's standpoint rather than from the standpoint of the general practitioner. The subjects are so indexed and headed that they can be easily followed, and so worked out that the subjects blend together very well. The work begins with the study of the cells, then the study of the tissues, and then the study of the individual organ, which is the proper basis and plan for the study of histology. We hope that these works will receive the recognition which they merit.

Crown and Bridge Work for Students and Practitioners*

DR. PEESO'S work on Crown and Bridge Work fills a long felt want in the dental profession, for he has been a recognized authority on certain phases of bridge work. The book as a contribution to dental literature is very valuable. It is especially interesting to orthodontists, due to the fact that it is one of the few volumes on crown and bridge work that lays particular stress on the occlusion of the teeth. We believe Dr. Peeso is among the first men to publish a textbook on this subject recognizing the basic principles of occlusion as being necessary to perfection and success in crown and bridge work.

For a number of years the majority of works that were written, dealing with crowns and bridges, dealt with particular technical phases of the subject, and their plan seemed to be the construction of the crown and bridge regardless of the service to be rendered in after years. Dr. Peeso's work considers the primarily important factor in the construction of the crown and bridge the making of one which will render physiologic service due to its construction along anatomic lines; and in order for this to be possible, occlusion must be considered one of the necessary features. The introduction to the work reads as if it had been written by a man who was an orthodontist rather than one who has given his time to crowns and bridges. But if we pause and consider, we realize that the basic principle of occlusion has as great a bearing on the construction of crowns and bridges as it does on the correction of malocclusion. We, therefore, realize that it is a great step forward which Dr. Peeso has taken in recognizing occlusion as the basic principle.

To those who are interested in the phases of crown and bridge work we heartily recommend this work, for we are convinced that a man who has such a thorough understanding and respect for occlusion of the teeth, which is necessary to construct a better crown and bridge, can write a better book than one who does not recognize these principles.

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*Crown and Bridge Work for Students and Practitioners. By Frederick A. Peeso, D.D.S., Director of the Dental Graduate Schools of the University of Pennsylvania. 752 illustrations. Published by Lea & Febiger, Philadelphia and New York, 1916.